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American Machinist

Editors
KENNETH H. CONDIT
FRED H. COLVIN

Volume 70 | New York, January 10, 1929 | Number 2

Two systems of applying

Pyroxylin Finishes

to Metal Parts

By L. P. Nemzek

Director of Sales, Industrial Finishes Division,
E. I. DuPont de Nemours & Company, Incorporated

TODAY we hear much about color and beautiful color effects. Our automobiles are finished in attractive color schemes, crack railroad trains are finished in distinctive colors, and somberness has departed from the furnishings of our homes. In other words, we are color conscious.

There are two distinct phases to this color consciousness: first, the purely esthetic; and second, the economic and utilitarian.

Let us consider the first of these two groups. Certain color effects are pleasing, and certain others are displeasing. Some colors are depressing, other colors stimulate. Attention has been given to these factors not only in the home, and in schools, but also in the treatment of individuals suffering from nervous diseases, where it is a recognized fact that certain colors are depressing and others are stimulating.

From the strictly utilitarian and economic standpoint, the selection of colors on the basis of their light reflective value is well known. All of us have noticed how dark, dingy rooms have been made brighter and more cheerful by choosing colors which possess good light reflecting qualities. We also know of instances where the use of light colors has made it possible for us to readily notice the presence of dirt. Painting the corners on stairways and in shops in white, is a familiar example of this. In other words, a light color shows up the dirt. Red is so thoroughly associated with the necessity for caution that we quickly recognize it as a danger signal, when used as a safety marker.

Color, because of its esthetic value, the aid which good light reflection lends, and the distinctive color marking of safety appliances, can be employed as a merchandising asset in the machinery field. Those who are employed around machinery naturally are forced into a somewhat monotonous routine occupation. Cheerful surroundings unquestionably assist in breaking down the monotony and result in less fatigue. Good lighting minimizes spoilage and accidents and results in greater production.

In a machine shop where the light is good, it is possible to turn out more and better work than in a dark, dingy shop. Bulky machinery introduces extensive surfaces, and if these surfaces are finished with colors with a maximum light reflecting value, the illumination is improved. This results in more accurate work and less spoilage, and the bill for illumination is less.

In industries where dirt, grease and smudge result in the spoilage of products, the use of a finish on machinery which readily shows up the dirt and smudge is of inestimable value. In the printing industry for instance, the use of white immediately brings to the attention of the operator any dirt or smudge which exists on the machine. The same is true with dirt, oil and grease which results in spoilage in the textile industry. Light colors bring the dirt vividly to the attention of the operators.

From a safety standpoint the use of color is helpful. Those portions of machines which are particularly dangerous can be marked in red, and those portions of the machine which are of considerable importance can be finished in distinctive and outstanding colors.

The willingness to use color is influenced to a very great extent by the availability of colored finishes which are satisfactory from a durability or service angle.

The automotive industry is a well-known example. Ten years ago automobiles were finished in sombre black. This condition was not brought about by the taste of the age, but by the fact that black baking japan was very much more durable than the bright colored finishes which preceded it. The automobiles of two decades ago were quite brilliantly painted. With the development of the automotive industry the demand for a durable finish and one which could be quickly applied resulted in the adoption of black baking japan and the pendulum swung to the sombre, because the color possibilities were limited. With the advent of the now well-known pyroxylin finishes, which made it possible not only to finish automotive equipment quickly, but also to produce a durable finish in colors, color again became popular and the interest in color today is largely attributable to the use of color in automotive design and finishing. The use of color spread from the automotive field to the furniture field and has

been carried over until it has become an integral part of present-day life.

The use of color in finishing machinery, particularly light colors, necessitates careful selection of finishing materials. A machinery finish by its very function should be resistant to oil, grease, gasoline and alkaline substances, as well as resistant to abrasion. Furthermore, it should be possible to clean the machinery readily without injury to the finish. This latter feature is especially important when light colors are used, as in that case it is essential that all dirt, grease or oil should be easily cleaned off. Perhaps the easiest way to accomplish cleaning is with a rag wet with gasoline. Gasoline resistance is, therefore, of prime importance in selecting a machinery finish.

Table I—Two systems of finishing rough castings

Mixed System	*All-Pyroxylin*
Oil primer	Pyroxylin primer
Brush or spray	Spray
Air dry 16 hours	Air dry ½ hour
Oil filler	Pyroxylin filler
Knife on in deeper indentations	Knife on in deeper indentations
Reduce for brush or spray application	Reduce for brush or spray application
Smooth or "leather" with chamois after 1½ to 2 hours	
Air dry 16 hours	Air dry 3 to 4 hours
Sand	Sand
Sealer	*Sealer*
Spray thin coat	Spray thin coat
Air dry 2 hours	Air dry 2 hours
Two coats pyroxylin enamel; ½ hour drying between coats	Two coats pyroxylin enamel; ½ hour drying between coats

Pyroxylin is insoluble in gasoline. Therefore, a pyroxylin enamel is eminently satisfactory as a finishing material for machinery. Not only is it gasoline resistant, thus permitting dirt, grease and oil to be removed very easily with a rag wet with gasoline, but it possesses the other attributes of a satisfactory finish for machinery; namely, durability and resistance to abrasion and speeds up the finishing program.

Although pyroxylin finishes have been employed in other fields for several years, their use as a finish for machinery is comparatively recent. This is due to the fact that it was necessary to develop satisfactory systems of fillers, sealers and undercoats to be used in connection with the finishing of machinery. This is particularly true of the filler, which must not only have the necessary film forming properties, but must possess the proper working qualities to make it possible to use it economically.

Finishing with pyroxylin systems requires procedure not substantially different from that necessary for the old type finishes. Rough castings require the use of a primer, filler, sealer and two coats of pyroxylin enamel to complete the finish. Smooth metal, such as is used in the manufacture of lighter machinery, requires a primer, spot putty, surfacer and two coats of pyroxylin enamel to complete the system. In the accompanying tables systems for both smooth metal and rough castings are described. Reference is made to all-pyroxylin systems and to mixed systems. The all-pyroxylin system makes it possible to finish a machine more quickly than in the case of the mixed system, but on the other hand the mixed system, which involves the use of an oil-type primer, is somewhat more durable because of the better adhesion to metal of the primer coat. The easier sanding quality of the oil-type filler is also an advantage as the harder and more compact nature of a pyroxylin filler results in slightly more difficult sanding. However, the superior alkali and oil resistance of the all-pyroxylin system is important in many fields.

Table II—Two systems of finishing smooth metal

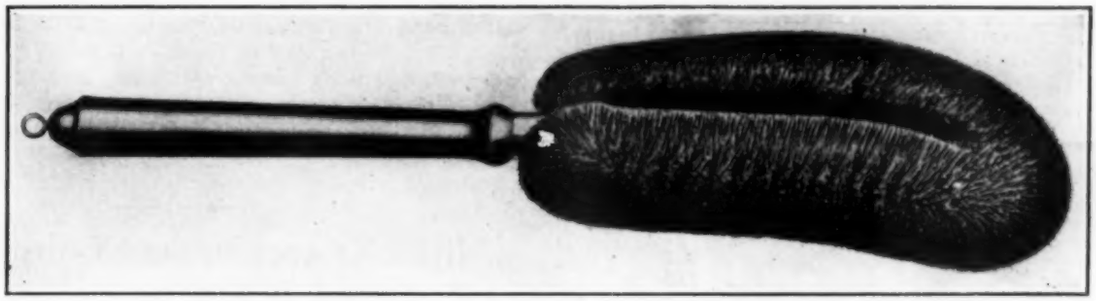
Mixed System	*All-Pyroxylin*
Oil primer	Pyroxylin primer
Brush or spray	Spray
Air dry 16 hours	Air dry ½ hour
Oil putty	Pyroxylin putty
Spot putty deeper indentations	Spot putty holes
Air dry 16 hours	Air dry ½ to 1 hour
Sand	Sand
Oil surfacer	Pyroxylin surfacer
Spray	Spray
Apply 2 coats 4 hours between coats	Apply 2 coats
Air dry 16 hours after second coat	Air dry ½ hour between coats Air dry 3 hours after 2nd coat
Sand	Sand
Two coats pyroxylin enamel; ½ hour drying between coats	Two coats pyroxylin enamel; ½ hour drying between coats

In summarizing, therefore, the use of pyroxylin finishes on machinery not only speeds up the finishing operation and thereby effects economies in space required for finishing rooms and investment in product in process of finishing, but also makes possible the wider use of color in the finishing of machinery. Color not only improves the appearance of the machine but has a marked effect upon the efficiency of the operator who uses it, which is reflected in the quantity and quality of production. The elimination of spoilage by freedom from dirt is essential in many industries.

The cost of the finishing materials used on the machine represents but a small fraction of the cost of the machine, and therefore makes it possible to employ the best materials to produce a given result. The value of the finish in its ability to meet the requirements stated above from a merchandising standpoint represents a latent potential and one which will be considered more and more in this age of color.

12th Semi-Annual Shop Equipment Review

Next week the editorial section will be given over to the 12th semi-annual review of shop equipment developments. As usual, the American and English sections will be separated and have separate indexes and contents lists. There will be 325 items in the American section and 153 in the English. The advertising pages will carry extensive catalog copy to round out the issue as a reference volume for the production executive and for the designing engineer.



Tools for Making Brushes

By F. H. Mayoh

BRUSHES of the type shown in the headpiece consist of a core of two wires twisted in such a way that the bristles between the two wires follow the spiral twist of the wires, so that the resulting brush is cylindrical in shape, with the wires in the center. This twisted brush is then bent, by means of simple hand bending fixtures, some of which will be described in this article, into the many shapes in which it is marketed.

The brush illustrated has black bristles, and the completed brush is bent into an oval shape with the ends of the wires swung outwards and glued in a handle, using a glue compound that will not soften in hot water. Generally speaking, the closer the bristles are trimmed to the wire the stiffer the brush will be, but the many grades of hair and fiber available make possible a wide range of variation in brush stiffness.

On the machine shown in Fig. 1, two wires previously cut to length are twisted with a quantity of hair or bristles between them to make the brush cylinder for the type of brush illustrated. The machine is made on the principle of a small lathe, except that in place of a tailstock a weighted slide is substituted, which is free to slide on the ways of the machine. The chuck *A* has two gripping jaws, having slots to receive the two wires. The operator first inserts the lower wire, and then spreads out the brush bristles on the guides *D* and *E*. He then inserts the upper wire *F* over the bristles, clamping both of them in the chuck, and then clamps the other ends of the wires in the vice jaws on the slide, one jaw of which is operated by the handle *J*. Revolving the spindle of the machine twists the wires, which are held firmly in the vise *H*. As the ends of the wires are turned the bristles twist into a spiral cylindrical shape. This operation of twisting the wires shortens the length of the wires, so that during the twisting operation the vise *H* is pulled toward the revolving chuck against the tension of the counterweight.

In some types of machines used for this purpose, the vise *H* is replaced by a gripping dog, in which a movement of the lever causes the wires to be gripped between the end jaws, either close up to the bristles, or at the extreme ends of the wires, while the slide *K* has stops arranged to register from the bed, and to stop the machine automatically when the desired number of twists has been made. The machine illustrated is controlled by the foot of the operator, and the latter becomes quite expert both in inserting the proper quantity of bristles and in twisting the brushes so as to produce a uniform article. The next operation after twisting these brushes is to trim the ends of the bristles, which is done by holding the wires at each end and revolving the brush against a revolving spiral cutter, which trims the bristles to the desired diameter against a shear bar. The brushes are next bent to shape in hand bending fixtures. The operation of bending the brush

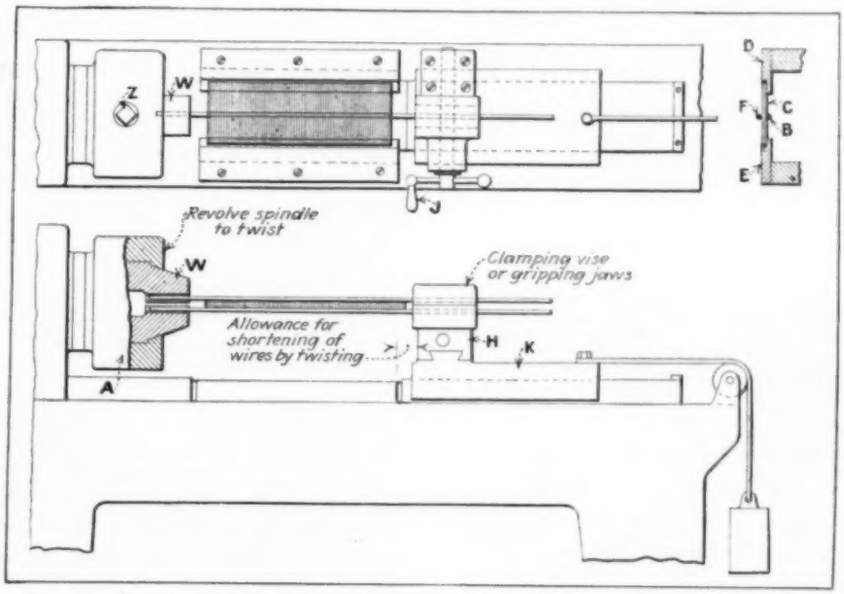


Fig. 1—Machine for twisting cylindrical bristle brushes. The wires are gripped in the chuck jaws and the bristles spread out along the guides D *and* E *between the two wires. After clamping the wires in the vise* H, *the chuck is revolved, twisting the bristles into the cylindrical shape*

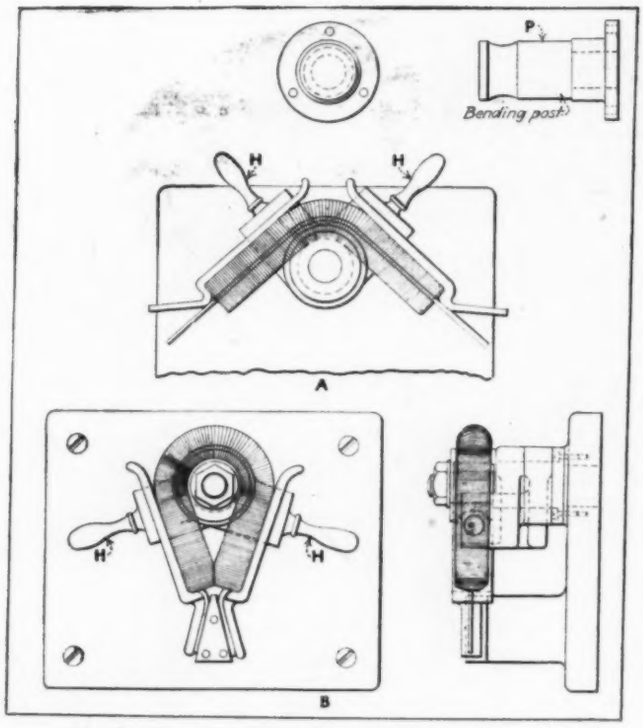


Fig. 2—Hand bending fixture for brush forming

shown in the headpiece is illustrated in Fig. 2. This bending fixture is for use on a bench, and is typical of the general method employed for bending this class of brush. The preliminary bending, which is shown at *A*, is done by the operator before inserting the unit into the fixture. It consists in gripping both ends of the bristles and bending them around the bending post *P*, which is located on the bench directly behind the fixture. The bend is made approximately to the shape shown, in which it enters the fixture. The swivel arms of the fixture are then pulled around by the handle *H*, which bends the brush to the desired shape and makes the short bend at the end of the wires that enter the handle.

In Fig. 3 is shown another type of hand bending fixture, which is used for forming what is known as a wall brush. The ends of the brush are bent by hand around the arbor *A*, and the operator then inserts the ends of the wires through the slot F in the lever pin. The operator next pulls out both handles, making the right-angle bends in the wire as shown. Brushes of this type are made in many shapes and sizes, and once having twisted the bristles and wire to the desired cylindrical length, the completed brush ready for the handle can be made simply and rapidly in hand-bending fixtures of these types.

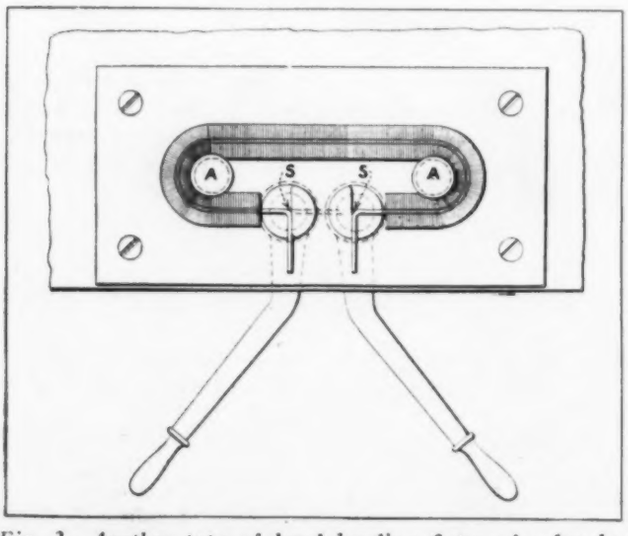


Fig. 3—Another type of hand bending fixture for brushes

Brine Quenching and Corrosion

By R. H. Ore

THE cutter blade of a fibre shearing machine gave much trouble by rusting in stores. Since other parts of similar steel in adjoining racks were quite free from rust marks the situation was a puzzling one. A remedy in the form of a vaseline coating was tried out. It was naturally rather expensive, and was found to be totally ineffective for the blades rusted in precisely the same manner as previously.

Search revealed that the cutter blades underwent a brine quench, whereas most of the other parts were treated in the more usual manner. A microscopic examination showed that the corrosive effects emanated from the interior and radiated outwards, instead of the reverse which is the general rule.

Apparently, during quenching a small amount of brine entered the steel. The salt accelerated oxidation which spread throughout the section, appearing finally on the surface. The internal oxidation resulted in a loss of 20 per cent tensile strength, and over 42 per cent loss in elongation.

A different grade steel was used and immediately removed all difficulties with only the slightest of increase in costs. For this particular job it has now become the rule to check steel deliveries by quenching a small test piece in brine, leaving for a few days, and then examining the structure. If the samples show corrosion, the shipment is rejected.

Preheating for Aluminum Welding

By A. Eyles

PREHEATING is desirable in welding aluminum castings to prevent severe expansion and contraction stresses, and to conserve costly gases. Experience shows that the preheating should not be less than 480 deg. F. and not above 750 deg. F. Higher temperatures yield no advantage. Welding operators can generally tell when the correct preheating temperature has been reached by rapping the casting. Another test is to apply dry sawdust. When the correct temperature has been reached, the casting will begin to char the sawdust. This latter method is the safest, as it enables the welder to tell at a glance whether he is heating uniformly.

It is not essential however to preheat all aluminum castings prior to welding. The corner broken off the flange of an automobile gearbox or crankcase for example, can be welded perfectly by commencing to heat up the corner of the gearbox with the torch flame, giving it sufficient time for the heat to radiate, and welding when it is at the right temperature. When the weld is completed, the flame should be manipulated gradually away from the weld toward the corner of the gearbox to allow for expansion and contraction. If a lot of welding is to be done on an automobile gearbox or crankcase, especially in different parts, it is advisable to weld it in stages.

Should a Buyer Specify Design or Results?

IT WAS a sort of three cornered conference regarding the purchasing and specification of machinery. Tom Jenkins, production man, Frank Barrows, machine salesman, Harry Hilker, a plant manager, and our consultant Bill Holland, were at lunch at the Business Men's Club, and as usual, a discussion was the result.

"Generally speaking, I agree with you, Barrows," said Jenkins. "What I want to buy is production, and I don't care so much what the machine looks like or how big it is, as I do what it produces. But there's an exception in this case. I wouldn't buy the best machine on earth unless it had a real lubrication system."

"You never had much trouble with our machines about oil, did you, Jenkins?"

"Not so much as with some others, I'll admit, Barrows. Your machines are so well designed that they stand more abuse from lack of oil than any I know. But we have had some trouble, and I'm not letting myself in for any repeats."

"Haven't we always made everything right when it did fail?"

"You have, Barrows, that's why I want to keep on doing business with you. But no matter how soon you have a man on the job, we lose production—not only on your machine, but on others in the line. And I'm darn sure we can cut out most of that if you'll put on a decent lubricating system."

"How do you feel on the subject, Mr. Holland?" asked Hilker, who had been listening to both sides.

"Jenkins has some good arguments all right," replied Holland. "Most up-to-date shop men are getting to look at production as the main point to consider—especially when the machine builder is known to be thoroughly reliable. On the other hand some have pet ideas that others might call hobbies, as to some features they consider essential, and they insist on these being incorporated in a machine. One fair sized machine user lets it be understood that he will not buy any machine with plain bearings. They must be either ball or roller—but he does except a well-known grinder. Jenkins here, wants to insist on a *real* lubricating system, regardless of the standing of the firm back of the machine."

"Seems to me," said Hilker, "that you can carry these hobbies too far. Now we build good machines with plain oil cups, and never have much trouble with them. I'd hate to have to equip them with any special pump jiggers that mean a lot of piping. And we guarantee them as they are now."

"You don't have the trouble, Hilker, it's the user," put in Jenkins. "I'm not fussy about most things, if a machine will live up to its guarantee. But I know men who are on piece work cannot be depended on to oil machines. I know what it costs us to have machines go wrong in production. It's not only the direct loss of service; it's the cost of repairs and the delay and confusion all along the line. And much of it can be avoided if the machine has a real system that gets lubricant to every bearing. Guarantees don't pay for incidental losses, confusion, and gray hairs."

"This seems to resolve itself," mused Holland, "into the question of whether the buyer shall consider only results or the way in which they are secured—in other words, details of the design of the machine. In reality, though, doesn't it get back to the one question of results? Isn't Jenkins balking on lubrication simply because it's his idea of the way to 'insure' results? Allowing that the builder knows how to build a machine right, Jenkins wants to be sure to keep it running. Is there any one answer that will suit all cases?"

Executives are invited to discuss the problem involved in the foregoing case. They are also urged to use this department to air their own problems. A letter to the Executive Forum Editor is all that is needed.

Discussion

The Man Over Fifty

A large employer of labor said to a man who had worked for him for about 25 years—"You have stayed here because it suited your convenience to do so, we have kept you because it

suited our convenience; we owe one another nothing." This is the old-fashioned point of view. Modern production methods wear out machines in say 5 years, and men by the age of 50 or 55, but machines and men ought not to be treated in the same way at the end of the period of usefulness. There is a moral responsibility for industry to pay off its debt in the form of pensions. With men moving from job to job it seems that the burden can be equally distributed only by a scheme on a national scale. In the meantime, it is up to the individual employer who feels his responsibility to lead the way. The best method I have come across is roughly as follows:

A group of employers bought up a small insurance corporation and used it for insuring their employees. A policy was taken out for each employee, and a premium proportional to his wage or salary was paid quarterly by the employer. In case of death before the age of 55, a sum equal to three years' wages is paid to the dependents. The policy is the personal property of the employee, except for the provision that the directors will refuse to recognize any loan or mortgage on it other than one advanced by themselves. After two years it has a surrender value equal to half its true actuarial value, and this value may not be realized as long as the policy holder remains in the employ of one of the participating firms. A policy holder under the age of 50 when leaving the employ of one of these firms may exchange the policy for one of a number of alternative policies on terms similar to those offered by other insurance companies. Over the age of 50 the surrender value of the policy for exchange purposes is its actuarial value.

On leaving the employ of the firm at the age of 55 or over, the policy is exchanged for a fully-paid-up participating annuity policy falling due on the first of the following month. In practice, the average leaving age is 60. The starting of this scheme involved a large initial expenditure for retroactive policies in the case of old employees. —H. JAMES, *England.*

Preventing Unfair Rejections

Almost every jobbing shop is confronted with so-called unfair rejections. In many cases the rejections if carefully analyzed are found to be more justified than appears in moments of hasty denunciation.

Who is unfair? Is the purchaser unfair for rejecting work not within the limits of the tolerances permitted? Or, is the jobber unfair, according to a code of ethics, for permitting such work to leave his shop? These questions may seem superfluous, but the answers depend upon whether you are the buyer or seller.

As to the case of the Milltown Products Company, it is my opinion that the responsibilities must be assumed by Mr. Parker. He decided that the inspector, Mr. Brown, should "forget it." Merely because previous lots of work were not rejected, even though the tolerances were exceeded, is no sound reason why this practice would continue forever.

When Milltown contracted to do the work, it did so with the understanding that it was capable of furnishing the products according to the specifications submitted. The tolerances were exceeded and the work shipped under the pretense of ignorance. Milltown was unfair to itself, and to the motor company for its action.

—PETER E. MCMANUS, JR.

Selecting Shop Executives

Finding new executives in industrial organizations is becoming more difficult every day, and the problem Mr. Milford was up against is being repeated in practically every industrial section of this country.

One reason for this is that some department heads are afraid to have an assistant who is almost as good as they are, feeling that there would be a tendency on the part of the management to replace them with the assistants at a lower salary. This is an error that a great many executives have made, and in 99 per cent of the cases this fear is groundless, as in progressive plants the preference is to retain an executive that they know they can rely upon.

I believe that progressive manufacturers should encourage their department heads to have real assistants, who can "step into their shoes" at a moment's notice. —CHARLES BRADFORD.

Paying for Special Designs

The practice of offering one man's special design to another for bidding without the consent of the designer, is a serious one in the machine tool industry. That it is unethical is admitted, but as Mr. Brown said, he has a board of directors to satisfy. Such designs obviously have the name of the firm that made the design on the drawings. Now, if the machinery makers got together among themselves, and agreed to refuse to bid on such drawings without a written release from the owner, wouldn't that settle the question once and for all?

If the prospective user of the machine, in order to get around the difficulty, retraced the drawings with his own name on them, he would be in the same position as the man who removed the manufacturer's nameplate from a machine and substituted his own before offering it for sale. This would be a clear case of fraud, and would not long be tolerated. Property rights in drawings should be just as much respected as in machines. —SAMUEL J. BAVIS.

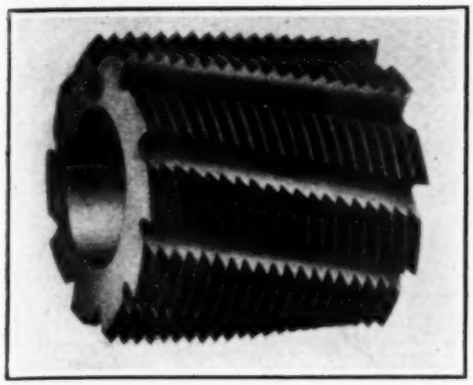


Fig. 1—Typical thread milling cutter

Some Observations on Thread Milling

By Prof. N. N. Sawin
Research Engineer, Skoda Works, Pilsen, Czechoslovakia

Correct operation requires the determination of the relation of the circumferential speed of the cutter to that of the work and to the number of cutter teeth

FOR quantity production of parts with short outside or inside threads, thread milling cutters, such as the one shown in Fig. 1, may be used with a great deal of advantage. Such a cutter represents in fact an aggregation of profile cutters, the teeth of which are *not* arranged in a helix, but are normal to the axis of rotation of the cutter. The length measured along the axis of rotation of the cutter must not be smaller than the length of the thread to be cut. The operation advances very rapidly, because the thread is finished after one revolution of the work *B*, Fig. 2, and after a longitudinal movement of the cutter *A* equal to the lead of the screw.

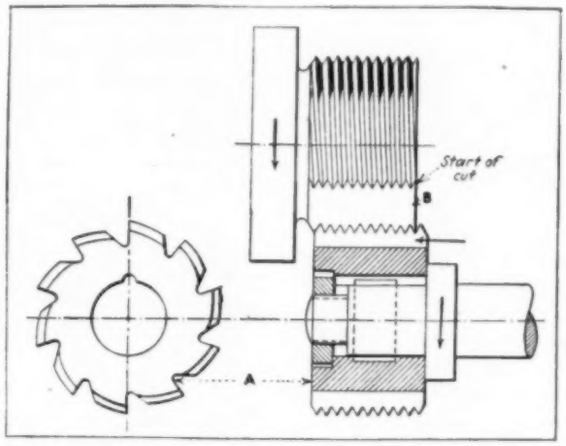


Fig. 2—Relation of a thread milling cutter to the work

Correct operation requires not only the determination of the speed of the cutter, but also a suitable adaptation of its circumferential speed to that of the work and to the number of teeth of the cutter to make sure that each tooth of the cutter takes a sufficient chip. It is well known that only a part of the teeth are cutting when the feed is too small: the balance does not cut but chews the stock and becomes dulled. Every irregularity in the movement of the cutter or of the stock, likewise every irregularity in the cutting edges of the cutter or in its true running, accentuates the irregular work of the teeth. The harder the stock, the greater the dulling of idle teeth at small feeds. The circumferential speed of the cutter depends on the hardness of stock and on the quality of cutter, such as carbon or high-speed steel; the feed of the stock depends on the type of thread, inside or outside; rigidity of the milling machine arbor; capacity of milling machine, and similar factors.

Let D = outside diameter of cutter in mm.
z = number of teeth of cutter
N = speed of cutter r.p.m.
d = outside diameter of work in mm.
n = speed of work r.p.m.

Then the circumferential speed of the cutter will be:

$$V = \frac{\pi DN}{1{,}000} \text{ meters per min.}$$

The circumferential speed of the work will thus be:

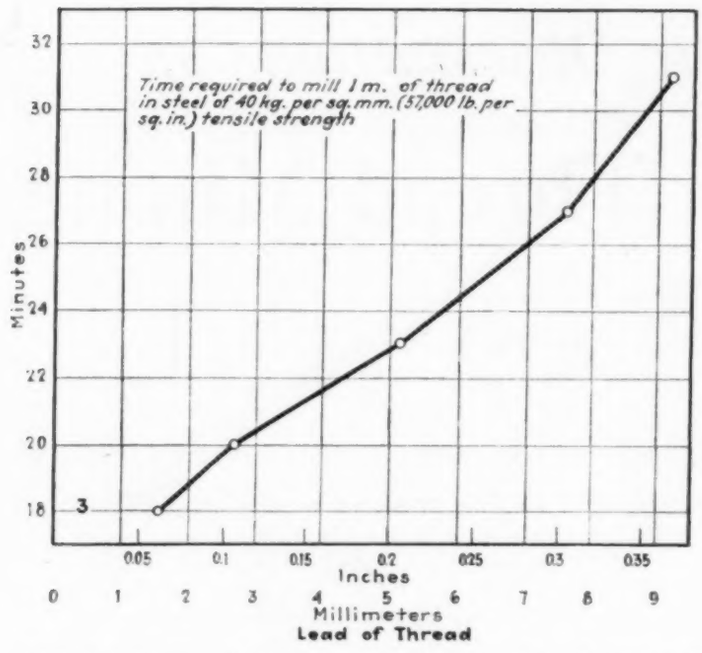
$$v = \frac{\pi dn}{1{,}000} \text{ meters per min.}$$

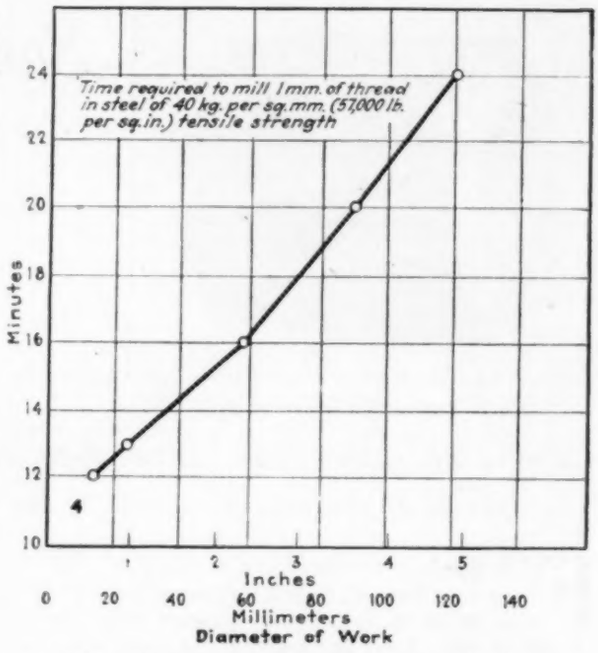
and the feed per tooth of cutter $= \frac{\pi dn}{Nz}$

Experience shows that the feed per tooth at highest efficiency varies from 0.02 mm. (0.0008 in.) for very hard and soft material to 0.06 mm. (0.0024 in.) for internal threads in material of tensile strength of 60 to 80 kg. per sq.mm. (85,500 to 113,500 lb. per sq.in.). The most efficient output of the cutter is the maximum length of thread* that can be cut by the cutter in stock with a tensile strength of 90 kg. per sq.mm. (128,000 lb. per sq.in.) before its ultimate deterioration in the shortest possible time; for instance out of two cutters, one was sharpened twelve times and produced 104.5 m. (342 ft.) of thread in 3,215 min., including the time for inserting and sharpening; the other operating with different feeds and speeds withstood only a tenfold grinding and produced 41.3 m. (135.5 ft.) of thread in 1,377 min. It is obvious that the speed of the former was more correct, because the first one until its ultimate deterioration produced a thread 2½ times longer than the second one in 8 per cent less time per meter (3.28 ft.) of produced thread. If we assume the price of the cutter to be $20.00, operator's wages $0.60 per hour, and overhead 200 per cent, the cost of the thread in first case is $1.11 in 30.7 min.; in the second case, $1.50 in 33.3 min. To elucidate the utmost importance of correct selection of the circumferential speed and feed further, the following example is added:

A customer refused a series of thread milling cutters, 39 mm. (1.54 in.) in diam., 12 teeth, 1.5 mm. (0.06 in.) lead, Poldi "Maximum" high-speed steel, with the remark that the cutter became dull after having produced 3.5 m. (11.5 ft.) of thread in steel of 90 kg. per sq.mm.

*The length of produced thread is equal to the feed of the work measured on its circumference.


Time required to mill 1 m. of thread in steel of 40 kg. per sq.mm. (57,000 lb. per sq.in.) tensile strength
Minutes
Inches
Millimeters
Lead of Thread
3


Time required to mill 1 mm. of thread in steel of 40 kg. per sq.mm. (57,000 lb. per sq.in.) tensile strength
Minutes
Inches
Millimeters
Diameter of Work
4

Figs. 3-4—Curves obtained from data presented by Herm. Walter, page 375, (Fig. 3), and W. Haberkonn, page 374, (Fig. 4), of issue No. 8, 1928, of MASCHINENBAU, *showing the influence of the lead of the thread and the diameter of the work, respectively, upon the time required to cut a meter thread in steel of 40-kg. tensile strength*

(128,000 lb. per sq.in.) tensile strength at a circumferential speed of 20 m. (65.6 ft.) per min. after one sharpening. According to these figures the output of the cutter was two times smaller than what is considered a standard performance in this kind of material. The customer, an authority on machining hard material, had the cutter working under obviously wrong conditions: the circumferential speed of the cutter was two times greater than standard and the feed per tooth three times smaller than that which guarantees a uniform lead for all teeth. An examination under a microscope disclosed the fact that the cutter was not dulled by cutting, but by squashing the surface to be machined.

Incorrect working conditions and the baselessness of the claims on the part of the customer manifested themselves in a test in which the customer's working conditions were compared with correct ones. Under correct conditions with steel of 95-100 kg. per sq.mm. (135,000 to 142,200 lb. per sq.in.) tensile strength, circumferential speed of cutter 8 m. (26.2 ft.) per min., feed 32.5 mm. (1.28 in.) per min. [i.e., 0.04 mm. (0.0016 in.) per tooth] the cutter operated two to three times longer after each sharpening than with the unusually big circumferential speed and unusually small feed per tooth at which the customer tried to operate it with a circumferential speed 20.5 m. (67.2 ft.) per min. and feed 30 mm. (1.18 in.) per min., or 0.015 mm. (0.0006 in.) per tooth. Under the customer's condition a certain number of teeth was not cutting at every revolution, but was hitting the surface to be machined at high speed, thereby dulling the cutting edges. In Table I is shown a comparison of these tests when cutting heat-treated ordnance carbon steel (95-100 kg. per sq.mm. tensile strength) and heat-treated nickel steel (100 kg.).

Up-to-date thread milling machines and thread milling cutters are built in such a way that the influence of the lead of the thread and the influence of the diameter of work upon the efficiency is relatively small; for instance, by increasing the lead of the thread [Standard (Metric) International or Whitworth thread] from 1.5 mm. to 9 mm. (0.0006 to 0.0036 in.) and by increasing the diameter of the thread from 20 to 100 mm. (6.8 to 3.94 in.), the time required to cut 1 m. (3.28 ft.) of the thread

Table II—Circumferential Speeds of Cutters and Feed of Work per Tooth of Cutter When Working Steel

Tensile Strength of Material in Kg. per Sq. Mm.	External Thread		Internal Thread	
	Circumferential Speed of Cutter in M. per Min.	Feed of Work per Tooth of Cutter, Mm.	Circumferential Speed of Cutter in M. per Min.	Feed of Work per Tooth of Cutter, Mm.
40– 50	30	0.02–0.03	25	0.03–0.04
50– 60	30–25	0.03–0.04	25–22	0.04–0.05
60– 70	25–18	0.04–0.05	22–16	0.05–0.06
70– 80	18–12	0.05	16–10	0.06
80– 90	12–10	0.05–0.04	12–10	0.06–0.04
90–100	10– 8	0.04–0.03	10– 8	0.04–0.03
More than 100	8– 6	0.03–0.02	8– 6	0.03–0.02

Cutter 35–45 mm. (1.38–1.78 in.) in diam., Standard International or Whitworth thread, 1–6 mm. (0.04–0.24 in.) lead, high-speed steel.
Work 20–60 mm. (0.79–2.37 in.) in diam.
: = 10–12.

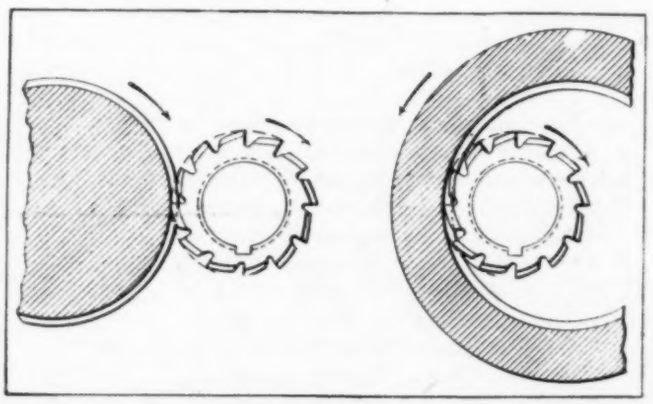


Fig. 6—Showing why the angle of action is greater when milling an internal thread than for an external one

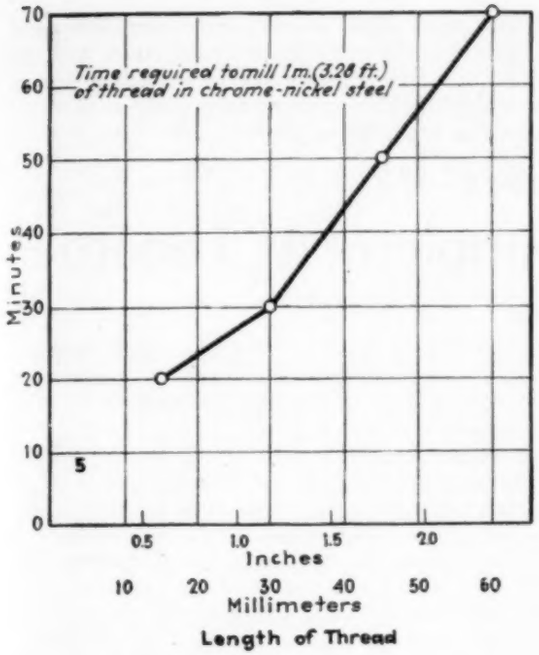


Fig. 5—Relation of length of thread to time required to cut 1 m. (3.28 ft.) of thread

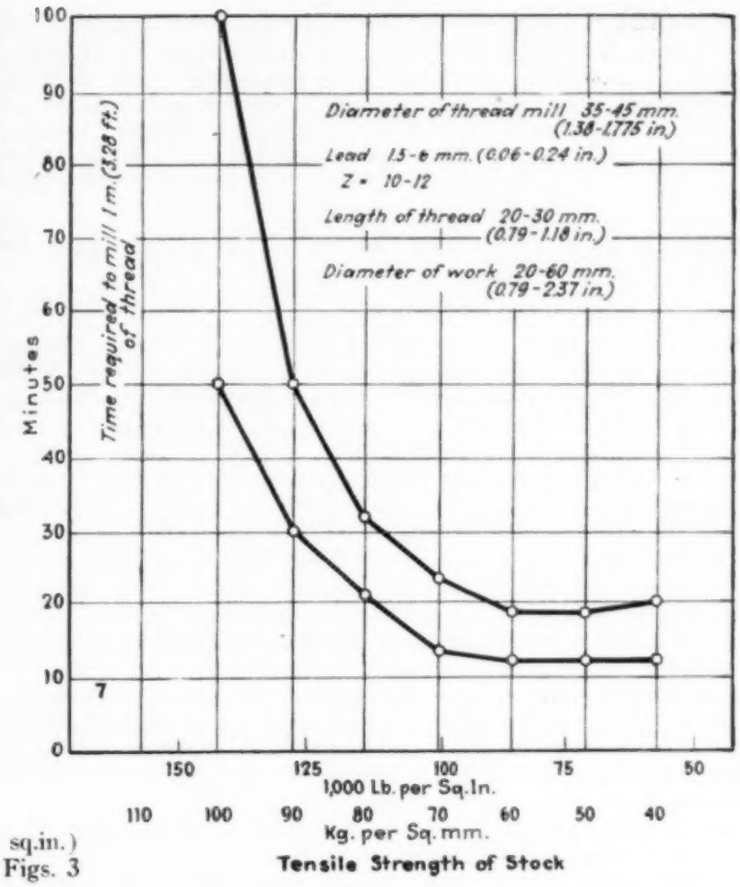

Time required to mill 1 m.(3.28 ft.) of thread
Diameter of thread mill 35-45 mm. (1.38-1.775 in.)
Lead 1.5-6 mm.(0.06-0.24 in.)
Z = 10-12
Length of thread 20-30 mm. (0.79-1.18 in.)
Diameter of work 20-60 mm. (0.79-2.37 in.)
Minutes
1,000 Lb. per Sq.In.
Kg. per Sq.mm.
Tensile Strength of Stock

Fig. 7—The data contained in Table II are plotted in this chart

in stock of 40 kg. per sq.mm. (57,000 lb. per sq.in.) tensile strength increases only by 70 per cent as Figs. 3 and 4 indicate.

In this connection it should be noted that the width of the thread to be cut must be taken into account since the time required to produce a meter of thread increases in the same ratio as the length of the thread: For instance, a cutter with 5 threads, lead 2.5 mm. (0.1 in.) required 20 min. to produce 1 m. (3.28 ft.) of thread in chrome-nickel steel, while 10 threads required 30 min., and 20 threads, 70 min., as shown in Fig. 5. To avoid overloading the machine the circumferential speed of the cutter and the feed of work must be reduced. (Bear in mind that the length of the milling cutter is equal to the length of thread on the work.)

Records of current types of thread milling machines when cutting different stock permit us to establish a table of standard cutting speeds (Table II) at which the machines deliver a standard output. In this table the minimum circumferential speed of the cutter and minimum feed of work per tooth of cutter corresponds with the maximum threaded length and maximum lead.

From the table it is evident that the feed per tooth of the cutter is equal for material of 50-60 kg. per sq.mm. (71,000-85,500 lb. per sq.in.) tensile strength and for material of 90-100 kg. per sq.mm. (128,000-142,000 lb. per sq.in.) tensile strength and that cutting of internal threads requires a slightly higher feed than for external threads. That this statement is correct is explained by the fact that in internal threads the angle of action of the cutter is greater and accordingly the number of working teeth is greater as is evident from Fig. 6. The work progresses more quietly with less interruption as a result. The cutter performance in minutes per meter of thread in different stocks, contained in Table II, is plotted in the diagram of Fig. 7. For instance: Time required to mill a meter of external thread in steel of 60 kg. per sq.mm. (85,000 lb. per sq.in.) tensile strength varies between 12 and 18 min.; in steel of 90 kg., 30 and 50 min. The lower figures refer to favorable conditions, that is, short lengths of thread as 20 mm. (0.79 in.) and small lead as 1.5 mm. (0.06 in.); the higher figures to less favorable ones, such

Table I—Comparative Tests with Thread Milling Cutters

Material Cut	Cutter Speed, R.p.m.	Cutting Speed in Mm. per Min.	Feed in Mm. per Min.	Feed for 1 Revolution of Cutter, Mm.	Diam. of Work, Mm.	Number of Pieces Cut to One Sharpening	Total Length of Thread to One Sharpening, Meters	Note
Ordnance steel 95-100 kg	65	7.96	32.5	0.5	79	30	10.78	Standard conditions
	65	7.96	32.5	0.5	76	14		
Ordnance steel 95-100 kg	170	20.5	30	0.18	76	14	3.34	Customer's conditions
Ordnance steel 95-100 kg	65	7.96	32.5	0.5	73	12	10.45	Standard conditions
	65	7.96	32.5	0.5	70	35		
Ordnance steel 95-100 kg	170	2.05	30	0.18	73	18	4.13	Customer's conditions
CNS brand of nickel-steel	65	7.96	32.5	0.5	79	20	8.85	Standard conditions
	65	7.96	32.5	0.5	77	16		
CNS brand of nickel steel	170	20.5	30	0.18	77	4	2.85	Customer's condition
	170	20.5	30	0.18	74	8		

Cutter 39 mm. (1.54 in.) in diam., 1.5 mm. (0.06 in.) lead, made of Poldi "Maximum" high-speed steel.

as long threaded lengths of 30 mm. (1.18 in.) and a lead of 6 mm. (0.236 in.). Of course the time does not include the slow start before reaching the full depth and preliminary measuring before starting to feed in the stock. The figures refer to work on up-to-date, efficient machines with short, rigid arbors; with older, less rigid machines the circumferential speed of the cutter and the feed of work must be considerably decreased, in consequence of which the time required to produce a meter of thread increases from 30 to 50 per cent.

Right of an Executive to Supplement Income

By Leslie Childs

EVERY factory executive has a right to engage in outside ventures for profit. He is strictly limited in matters of this kind, however, if they are connected with his employment. To put it another way, he will not be allowed to use his employment as a source of "side money," if this in any way conflicts with his employer's interests.

Obviously, general rules are of little value in covering this subject since each case of this kind must be decided in the light of facts and circumstances. As an illustration of how the courts view situations of this kind, the case of a certain Michigan manufacturing company is taken.

In this case the plaintiff employed the defendant as general manager of its factory for a period of five years. This contract of employment contained the following provision, in respect to the duties of the defendant in his employment:

"The second party agrees to devote all of his time to the interests of, and for the benefit of the first party, for the full period of five years, and not to engage in any other business, during said period, which would in any way conflict with his duties to the first party, the first party to be the judge in the matter."

A Side Venture in Steel

During the course of this employment, the plaintiff required 200 tons of 20-gage steel to use in a contract it had taken, and its board of directors authorized the defendant to make the purchase. The defendant located a stock of 700 tons of steel for sale, but this steel was 20 and 22 gage and the owner declined to sell less than the whole lot.

In this situation, the defendant purchased the entire lot on his own account, turned over the required amount to his company, and sold the balance, at a profit of $5,000, to other buyers. This entire transaction was carried through by the defendant without the knowledge or consent of his board of directors.

Now, at this point, it may be noted that the defendant did not defraud the plaintiff, his employer, in any way. For all that appears, the plaintiff got the steel it required at a fair price, and as cheap as it could have gotten it in any other way. But the fact remains that the defendant, acting in the course of his employment as general manager of the plaintiff, made a profit on the deal.

Following this, the plaintiff's directors, in some manner, obtained knowledge of this transaction, and called upon the defendant for an explanation of the matter. The defendant took the position that he had the right to buy and resell the steel as he did, and that he did not owe the board of directors any explanation. The dispute that followed led to the discharge of the defendant, and the board of directors brought the instant action to compel the payment to the company of the profit the defendant had made on his steel marketing venture.

The cause reached an appellate court on appeal, and here, in upholding the right of the plaintiff to recover, the court reasoned as follows:

"The defendant was not only in the service of the plaintiff, employed as its general manager, one of his duties as its agent being to purchase steel for its use, but he was also a director and officer of the corporation. It was his duty to make the best bargains possible for his company.

"By the terms of his contract of hiring he expressly agreed to 'devote all his time to the interests of and for the benefit of' plaintiff, and while in its service 'not to engage in any other business which would in any way conflict with his duties' to it, as to which matter, plaintiff was 'to be the judge.'

Opinion of the Court

"In the steel transaction, where he admittedly made a profit, he assumed to be the judge of whether his interests conflicted with his duties, refused to discuss the question with plaintiff's directors, and told them it was none of their business.

"But, independent of the express terms of his hiring, as to engaging in other business, it is an elemental rule of agency that his duties requiring his efforts and activities in the line of his employment should be for the benefit of his principal, and he was not at liberty to deal in the business of his agency for his own benefit. It was his duty to communicate, to his principal, facts relating to the business, which ought, in good faith, to be made known to the latter.

The trial court decided that defendant's discharge was justified, and the conceded profits made by him in the deal were made in connection with, and in execution of his agency, and belonged to plaintiff. This authority takes the position that the test in situations of this kind is whether the acts of an executive in making "side money" conflict with the interests of his employer. In other words, the employment, itself, cannot be used as a source of extra money by an employee, in the absence of a full disclosure to, and consent on, the part of the employer.

Soft spots in cyanide hardening are a frequent source of annoyance and various explanations have been offered for their occurrence. In pack-hardening where the pieces are packed with bone or other carburizing material, a soft spot is usually considered to mean that the pieces touched or did not have sufficient carbonizing material between them. But this explanation does not hold where a cyanide bath is used. It is recommended in cyaniding that the preheating does not go over 700 deg. F. unless the preheating is done in a separate cyanide bath, in which case it can go to 1,200 deg. Fahrenheit.

Carboloy and Tungsten-Carbide Tools

By Samuel L. Hoyt
Research Laboratory, General Electric Company

The most promising fields for this material are those of machining abrasive materials, fiber, Bakelite and metals at high speeds and comparatively small feeds

CONSIDERABLE interest has been shown in the past few years in the new tool materials which have tungsten carbide as a base. The present discussion aims to present certain features which will be of particular interest to mechanical engineers. The name "Carboloy" has been adopted by the General Electric Company as its trade name for materials of this type.

Tungsten carbide may be classed as one of our hardest materials, coming just below the diamond, and in addition it has a metallic rather than a non-metallic nature. To this it undoubtedly owes is present position as a tool material, for it unites with cobalt and similar metals to produce a combination of strength, hardness, and toughness which is absolutely unique among materials of its class. With a strength which is over half that of high-speed steel, its Brinell hardness number runs to over 2,000. In addition, it loses none of this hardness, as steel does, by having its "temper drawn" when heated, but retains its metal-cutting hardness at a bright red heat.

> Greater freedom from concern as to the ability of the cutting edge to stand up to high speeds is promised for many operations that are now done in such a way as to conserve the tool or its cutting edge

At present Carboloy is made in relatively small pieces, ranging from $\frac{1}{4}$ in. to $\frac{3}{4}$ in. square, with a length up to several inches. It is also made in disk form, in sizes up to $1\frac{1}{4}$ in. in diam. and $\frac{1}{2}$ in. in thickness, and as thin blades and drills for experimental purposes. It is made up in tools either as a tool bit held in a holder, or as a tip brazed on a steel shank. Sometimes a bit is brazed onto a shank and used in a tool holder. In this way it is possible to make tools which are large enough to perform most machining operations. With the same technique tools of special shapes can be made up for handling special cuts in production work.

Those who have had similar experience with the brazing of high-speed-steel tips, will be skeptical as to the utility of a tool made in this manner. Experience has shown that the failure at such joints is largely due to heavy pressures and high temperatures, and particularly to the former. When it is borne in mind that the natural strength of tungsten carbide holds down the pressures brought about in practice well below those which are probably used with brazed high-speed-steel joints, it will be clear that difficulties from this source are not as serious as they are with high-speed steel. In other words, it is probably much easier to make a brazed joint with tungsten carbide which is as strong as the carbide itself, and so to remove the joint as an impediment to the use of the material. The only work which is likely to give trouble from this source is that on steel, and the laboratory's experience here shows that brazed joints are practical for some applications. Tungsten carbide itself will probably never be able to handle heavy hogging cuts on steel, so that the ability of the brazed joint to withstand that service may never need to be tested.

The brazing is done by the methods of "copper brazing," which have been studied in rather great detail in the past at the Research Laboratory. This experience has been available for the work on Carboloy tools and has contributed greatly to the company's success in that field. The materials of the tool bits and of the shanks offer no particular difficulties, and to date many different tool compositions have been brazed to shanks of cold-rolled steel, machine steel, high-carbon or tool steel, nickel steel, high-speed steel, and a few special compositions.

The shank itself is now generally made of medium-carbon nickel steel. In some respects high-speed steel is superior to nickel steel, for it can pass through the hydrogen brazing furnace without coarsening. The carbon steels come out with a very large grain structure, and are comparatively weak as a consequence. But, it has been found in practice that high-speed-steel shanks are too apt to split open, or at least to check so badly that the tool is lost the first time it is put into the tool post. Nickel-steel shanks come through the brazing treatment in good condition for use in the shop, and in the process about to be described, nickel steel has a decided advantage over high-speed steel.

The shanks are first ground to shape on an automatic grinder to give the desired cutting angles and shape for the finished tool. With nickel steel this operation can be rapidly and economically done. A slot is then milled out of the nose of the tool, into which the tool bit proper is copper brazed.

Other methods of uniting bit and shank have been tried, but it has been the experience that a rigid joint, such as would be secured by welding, is too apt to split

Abstract of a paper presented at the annual meeting of the A.S.M.E., December 3-7, in New York.

at the joint or in the immediate vicinity. This failure may occur shortly after the weld is made or after the tool has been put in service. In other words, it is better to have a soft cushion between the bit and shank which can take up small stresses that may be caused by the different coefficients of expansion of the tungsten carbide and steel. On the other hand, it has also been observed that too much metal is bad. The pressures and temperatures involved are apt to force metal out of the joint, and to rob the bit of its support directly beneath the point. This action leads to breakage of the tool. By controlling the copper brazing and the design of the tool, it has been found possible to reduce this hazard to an unimportant factor while still retaining the valuable cushioning properties of the copper joint.

The tool sizes and shapes are not greatly different from those used with high-speed steel, although it has been found desirable to depart somewhat from the standard angles for some work.

Difficulties in Grinding Carboloy

The question of grinding Carboloy may occur to some as being rather serious. From what has been said, it is obvious that the softer wheels, such as emery, are not suitable. The only commercial material which is hard enough, and available in wheel form, is silicon carbide, so that wheels of the carborundum type have been used. These have proved to be satisfactory and sufficiently rapid for economical production. A coarse grade is employed for roughing, with very much the same technique that is used with high-speed steel except that no water cooling is permitted. Light pressures must also be used to avoid setting up excessive stresses in the metal. A fine carborundum wheel puts a sufficiently keen edge on the tool for most machine operations.

Surface grinders are used to prepare tools of special shape, in case the dimensions are to be held within close limits. However, tungsten carbide is so hard that the wheel wears away much more rapidly than is customary with ordinary tool materials, and this circumstance introduces a new factor if the tolerances are small. With the carborundum wheel wearing away continuously, a single cut cannot produce a plane surface, so that special methods must be employed to shape this material with close tolerances. With the methods of lapping, and particularly of diamond lapping, it is perfectly possible to work with Carboloy to a half a mil or even closer.

Ordinary machine-shop grinding practice requires simply the two grades of carborundum wheels. An operator can be readily trained to grind the tools properly, and no particular difficulties may be expected from this source.

Sufficient information has already been given concerning the properties and behavior of tungsten carbide to enable us to predict, on that basis alone, the most promising field for its use, namely, that of machining materials which are so abrasive that ordinary tools are speedily worn away and lose their cutting edge but which do not exert great pressures on the tool.

In one case Bakelite blanks were being machined. The speed was about 600 ft. per min., which was as fast as the machine could run. At this speed the tools had to be removed and redressed about every 150 blanks. At the end of each run a few blanks would be lost on inspection. At the start of each run a few more would be lost in getting the tools properly set up. Furthermore, the finish required on the parts necessitated a certain definite shape to the tool, and this was not always obtained. At different times a few parts would be lost at the beginning of the run because of this, and more time would be lost, and the tools would have to be redressed and reset. This job was equipped with Carboloy tools of the same shape as the standard tools, and, with the same operating conditions and inspection, 11,000 blanks were finished before the tools required redressing. This gives a ratio of about 70 to 1 in performance, while the other advantages secured with the use of the carbide tools may easily be seen by those engaged in such work. It would seem logical to assume that a change in performance of a whole order of magnitude, or more, would justify a radical change in the method of doing a particular operation. Such a change in process might well lead to a much more important improvement than that of increasing the durability of the tool or increasing the speed of the operation.

A case in point may now be given to illustrate this factor. Corrugated porcelain insulators are made from cylinders of green porcelain by hand-turning the grooves on a lathe, using the methods of wood turning. The green mixture is not hard in the ordinary sense, but the particles of grit are very abrasive to the turning tool. The very hardest steel tool would lose its edge in about fifteen minutes, while the amount of time spent by the operator in dressing his tools would amount to an appreciable portion of his total time. Carboloy tools were tried out on this job in the same way, and found to last so much longer that the time saved in grinding would soon save the cost of the Carboloy tools and make their use economical, in spite of the fact that the steel tools cost this shop nothing. The greatest improvement in practice, however, came from the change of the operation from hand to machine. The tool life was formerly so short that machine operation was not feasible.

Tests on the machining of fiber have brought out another advantage of using tungsten-carbide tools as compared with those of high-speed steel. The speed corresponding to the economical tool life of high-speed steel on fiber lay well below the speed at which the best surface finish was secured. This situation was completely altered by using Carboloy tools on such jobs, for the increased speed resulted in a material improvement in both production and finish.

Not Suitable for Hogging Cuts

Heavy "hogging" cuts running 1 in. deep with $\frac{1}{8}$-in. feed seem now to be outside the range of carbide tools. Here the size of the work is large, the speeds are necessarily slow because such large masses of metal cannot be moved very rapidly, and the necessity for speeding up the removal of metal requires the use of heavy feeds. Furthermore, the tool size must be kept within reason, and therefore the tool pressure, and the unit tool pressure, are inordinately high. These conditions seem to be very unfavorable for the use of carbide tools.

As the size of the parts decreases, the cuts taken decrease and the speed of machining increases. Here we begin to enter the field where the carbide tools are more likely to compete to advantage with the steel tools, for tool pressure becomes of less importance and cutting efficiency of greater importance in tool performance.

The rapid removal of metal with tungsten-carbide tools requires the use of lighter feeds and higher speeds than with high-speed steel. From this it follows that the position of high-speed steel becomes more favorable if the conditions do not restrict the feed which can be used, for high-speed steel removes metal faster by using heavy

teeds and slow speeds than by light feeds and high speeds. This circumstance is probably due to the strength and cutting efficiency or resistance to tempering of the high-speed steel. The carbide tool, on the other hand, may be said to be limited to the lighter feeds due to its lower strength, and it is only in case that high speeds can be used that the newer tools will be able to compete with our present tools on a favorable basis. The cutting efficiency is so high that it probably will not enter noticeably as a limiting factor, but it will at least serve to lengthen the time between grinds.

If the conditions are such that light feeds must be used, for finish or to avoid heating the work, then the carbide tools are placed in a more favorable position, for, in taking those cuts which do not overload the carbide tools, they have a greater life, than those of high-speed steel, at twice the speed. In this field it seems to be good practice with high-speed steel to take cuts whose cross-sections are of the order of 1 per cent of the tool cross-section. It will also probably be advisable to adhere to this chip-to-tool ratio, or even stay below it, with the carbide tools. The actual values of the feeds which may be held in mind here are from $\frac{1}{32}$ to $\frac{1}{64}$ inch.

Machine Design Must Keep Pace

Experience at Schenectady has shown that machines which do not permit much higher speeds than those now used; may not use Carboloy to the best advantage. The tool, when used on these machines gives greater durability, but does not speed up production commensurate with its inherent cutting efficiency. We may predict, therefore, that a study will be made of the new tool material and that machine-tool equipment will be designed to translate the possibilities of tungsten carbide into performance. Operations which are now done at low speed, or manually, will be done by machine and at much higher speeds. Operations which are now done in a way to conserve the tool or its cutting edge will be done with greater freedom from concern as to the ability of the tool to stand up. Operations which are now done singly will be combined and done automatically. Operations which now permit fairly large tolerances and which are to be followed by finishing operations will be done in one operation to finished, or nearly finished, size. Some operations which are now done wet will be done dry, for it is not so necessary to keep the tool cool. New ways will be found to perform old operations, and new materials will be machined which are better adapted to certain engineering requirements than those now in general use. Time alone can divulge the steps of this development and the extent of the changes which will follow.

While it is not the author's intention to discuss the cost of tungsten-carbide tool material, it may be well to mention that it is made from relatively expensive ingredients and by a process which is necessarily more expensive than the usual steel-making processes. It is also much denser than steel. It is evident that Carboloy must stand at a disadvantage on a weight basis, and still more so on a volume basis, as compared to high-speed steel. On a tool-for-tool basis the two are brought more nearly to a parity, for only a relatively small portion of the whole tool is made of expensive material. The vital point, in the author's opinion, is the relative performance of the two materials. On this basis the relative economic value of Carboloy as compared to high-speed steel will vary with the nature of the material machined and the operations performed, and it will be necessary to determine this factor for each new application. It is probably obvious, from what has been stated, that the economic value of Carboloy will be so great in many instances that its use will be justified at once. In other cases this preponderance will not be so great, and some study will be required to determine the more economical tool material. In still other cases Carboloy will be less economical than other tool materials, or not suitable at all. Among the latter applications may be mentioned finishing cuts on iron and steel, hogging cuts on steel, or, in general, cuts with heavy feeds and those which impose heavy pressures on the tool.

Galvanizing and Steam Cleaning Machines

CLEAN machines and a clean shop are desirable from several points of view. A clean shop is more attractive to both workers and to visitors and secures a better class of men. Moreover, it directly and indirectly affects the quality of the work, both by its suggestive effect on the worker and by reducing the hazard of dirt and foreign matter getting into the bearings, or between the joints, of the machines being built. Clean machines also affect both the quality of work and the life of the machines themselves.

One large concern has developed a novel method of cleaning the machines in its plant. A portable, kerosene-fired boiler that generates steam at 100 lb. pressure has been rigged up, and the outfit has a flexible hose for blowing steam directly on the machines. This method has proved to be both rapid and extremely efficient, more so, in fact, than any other plan that has been tried, both as to cost and the condition of the machine when completed.

This plan was objected to at first because it was feared that the steam might dilute the cutting compounds. The results did not bear out this apprehension as no appreciable difference was noted in any cutting compounds using soluble oils. Where pure cutting oils were used the effect was not as satisfactory, but as these cases were few it was not a serious objection.

The average machine can be thoroughly cleaned by using the steam hose in from three to five minutes once a week. On machines that for any reason are only cleaned every two or three months, it may take from ten to fifteen minutes. This time will also cover machines that have never been cleaned on the inside of the ways and body and also is ample for exceptionally large machines.

One drawback to the method is that the average paint used on machines does not stand the steam treatment well. The company is looking for a better covering for its machines. Pyroxoline finishes, or lacquers, are said to have advantages in cases of this kind but the plant in question is considering tin-plating or galvanizing the bases and such parts of machines as are now painted. In fact they have, it is understood, tried out this method on a few small machines.

The plan is to clean the castings thoroughly and dip them in a vat of molten tin, or zinc, before they go to the shop to be machined. This process would give a coating of tin or zinc, that would be rust proof, that would make the shop lighter and that could be steam cleaned without difficulty. Any local defect could be touched up with a soldering iron at small cost and all the expense of painting would be eliminated.

· THE · FOREMAN'S · ROUND · TABLE ·

The following narrative is a "case" presentation of the topic. It has been written to involve some of the questions that arise in the average shop. For guidance in preparing discussion the questions at the foot of the page have been prepared

Instructors for Shop Men

"YOU remember when we talked about teachers for the men, Al, after Wormser spoiled that lot of shafts for me, and you bawled me out for not playing nursemaid to machinists who ought to know how to do the work anyhow?" said Ed, as the two foremen friends settled down in their favorite seat on the homeward-bound train.

"Yes, I remember, Ed. What about it?"

"Well, your idea seems to be catching, like small-pox. Bill Jones tells me his firm has put in a real instructor, with a sort of a school shop and everything. I can't see it myself. When you hire a machinist he ought to be a real machinist."

"Now look here. Why waste time talking about the millennium? Of course they ought to be real machinists. But how many of them are? And, when it comes to that, how many of us are real, hundred per cent foremen? Answer me that."

"But I don't like this teacher stuff, Al. I don't want anyone to come snooping around my department trying to tell my men how to do the work."

"You're imagining things, Ed. I'm betting there won't be any 'snooping.' But suppose we had a man who had the time to show some of your slower men just why they didn't get the work out faster. Or suppose we took a man whose work had to be watched too closely and made him a real machinist. You wouldn't kick at that, would you, Ed?"

"Sounds sort of fairy-like to me, Al. I don't believe in schools. They've got to learn in the shop."

"That's a back number notion, Ed. Of course schools can't turn out men with ten years' experience. But they can take a boy and give him a pretty sound notion of why things happen in a lathe or planer, or what not.

"I know one shop where they have a school for those who don't make the grade in the production line. A few days in school usually speeds them up so they can keep up with the procession and not clog the works."

"I still think the shop is the only way, Al."

"I used to feel the same way, Ed. But I've changed my mind. A real teacher can do wonders with men or boys. I know of cases where they have made good workers out of men that the foreman didn't have time, or didn't know how, to do anything with. It's a real knack, Ed, and I'd be mighty glad to have a man who could polish up some of my lame ducks. I'm for it."

Is Al over-optimistic as to what instructors can do for men who are not all they should be? Is Ed right in fearing interference with his men? Or is there a middle ground?

All foremen are urged to discuss these questions vital to their work; of course the

discussion is not limited to foremen. Letters accepted and published will be paid for

Discussion of Earlier Topics

Finding New Ideas on Shop Visits

UNLESS a man can see a path of promotion straight ahead where he is, he is very foolish to turn down the offer of a better job. Policies change so suddenly, and the unexpected happens so frequently, that a promise, unless made by a responsible person, is of little value compared with a definite offer. If an executive can make a definite promise of a higher position to a man he should do so. Vague hints are unfair, leading as they often do, to misunderstandings.

A good man need seldom be lost if the shop really wants to keep him. If the foreman can make him a better offer than the other fellow can, and has always treated him fairly, he may decide to stay, or at least, he will come back when he is needed.

Appreciation is worth several dollars a week to anyone, and costs very little. In a shop where good feeling and fair dealing are the rule a man will often, when he has the offer of a better job, frankly state his case with full confidence that he will be treated honestly.

—H. W. JAMES, *England.*

AVERY progressive and far-seeing company advocates the policy of having its foremen visit other shops to secure new ideas on production methods, shop practice, and other subjects bearing on efficient plant operation.

New ideas can be found through the medium of shop visits, provided that the foremen know where to look and what to look for in the other shop. Intelligent questions, asked in a courteous manner, will lead the way to an exchange of ideas and experiences between the foremen visiting, and those being visited.

The preparation by Williams of a list of things to look for, and having the visiting foremen report on what they find, is a good policy.

Ed may not see the reason for answering questions relative to what he has been told to observe in the other shop, but he is helping himself as well as the company in bringing his ideas and observations of the other shop's operation to the attention of his own.—R. D. GUNNIS.

Asking a Man to Come Back

OF COURSE, Ed should have investigated the source of the trouble before any drastic action was taken. Once his mistake is realized, Ed should have a heart-to-heart talk with Frank, offering him his position again. This should be done for the sake of Ed, Frank, the company, and the employees. If Ed does not retract his decision, his failure to do so will be severely criticised and his sincerity and squareness will be doubted. Frank will tell of his discharge, spreading ill will, and possibly Ed will lose his position through not being able to control himself. If Ed, as soon as he learns of his mistake, would go to Frank and apologize for his hasty action, Frank would probably accept the apology and return to work, thus saving the company a good man and considerable money. The boys would respect Ed for his decency and believe he would be more careful in his decisions.

—P. B. BROWNE.

THE · NEXT · TOPIC

Shall a Man Sit Down to Work?

ADVANCE QUESTION

In a neighboring shop the boss bawls a man out for sitting down at his job. Ed thinks it may be necessary for discipline. Al doesn't agree at all. What do other foremen think?

Letting Good Men Get Away

AL IS certainly right in feeling that a good worker should be told of future possibilities. There is no reason why a few words of encouragement should be withheld. When a man is not told that his work is good, he will think that the foreman is taking no notice of him, and, as a result, his good work will slacken, or he will work elsewhere. You can easily let a man know, without promising anything, that you hope to advance him in the future by simply telling him to keep up his good work and look ahead.

—EDWARD PIRANIAN.

Capitalizing Criticism

I REGARD the idea of letting the foremen get together and criticize all departments as an excellent one. True, the function of co-ordination is the Super's, but in general his control really applies to policy and procedure in their broad aspects, and to such specific matters as come to his particular attention.

In the up-to-date manufacturing organization each department is well organized, so that the opportunities for further economies and improvements are rather limited. Not so, however, in the relationships between the departments. Here, there are still many loose ends, depending in great part for their continuance upon a lack of understanding by one department of the problems of another. This is where the "get together," if well directed, would find its greatest field of usefulness.

A frank report as to the effect of a delay, a carelessly

performed operation, a loose inspection or a substituted cheaper material, will show the offending department that there is more foundation to such complaints than the mere desire to "kick." Ideas which save time and money in one department may be found on discussion to apply equally well in others — either directly or with slight modification. —G. J. MAHON.

FOR years we held weekly meetings of foremen and others interested in production, and because of the criticism offered at them trouble and friction resulted throughout the plant.

Each foreman was intent upon having the presiding executive feel that any fall down on production was the fault of the other fellow, and the recrimination did not stop with the meeting. It is very difficult to keep such a meeting impersonal.

We had a production manager who, to stimulate production, would tell one foreman what another one said about his department, which caused further trouble. It finally became necessary to curtail both the meetings and the activity of the production manager, and constitute the works manager the sole dispenser of criticism. This course was productive of better feeling and increased output. —CHAS. H. WILLEY.

Making Foremen—or Importing Them

I KNOW from personal experience how it hurts, and how long it takes to get over it, when new men are brought in to fill good openings. On the other hand, an occasion sometimes arises when the logical man in point of service is not the best material, and when it would be necessary for efficiency's sake to choose a better man with a shorter service record.

When this necessity arises, it is often wise to bring in an outsider to avoid jealousy and dissatisfaction with the choice. The decision is important enough to justify a study of the problem from the standpoint of popularity of the prospective foreman, and his ability as well, and not let length of service be the only deciding factor.

—J. C. P. BODE.

ANY superintendent who needs a foreman and gets one who fills the bill, is sufficiently fortunate so that he is immune to criticism of his source of supply.

If he thinks that he has no suitable man to fill the place from within the works, he goes outside. He may be mistaken; the very best man may be where he has to step on him to get out into the shop. His very nearness to his men may make him blind to their good qualities. The man may believe himself fitted for the job, but be unable to sell himself into the better job. Very few men combine the ability to do good work and to sell. The very fact that he is a good workman makes it unlikely that he can make the superintendent think of him as an executive. If he is not noticed, and promoted, he and all his friends may be sore, and without intending any harm they may make a lot of trouble for the man who does get the job and a lot of loss for the shop.

It behooves the superintendent to be very careful that he is not overlooking good foremanship timber in the shop before he goes outside, and even then, if he does not find it in the shop, it may be that he is somewhat to blame. He may have a man whose knowledge of the work is all that can be desired, but whose temperament does not fit him to manage others. He may have a man on the other hand whose temperament is right but who has never taken enough interest in the work to learn its details outside of his own particular job, or he may have a man who has both the temperament and the skill, but whom he has not noticed because the man did not advertise himself. It is part of a superintendent's job to make skilled men out of unskilled, to better the temperament of his men, and to know his men and recognize whatever merits they have. —ENTROPY.

Does Appearance in Tools Count?

A WELL made and substantial article of any kind, whether it be clothing, a machine, a fixture or jig, invites respect, and receives better care than it would if poorly made and finished. Appearance goes a long way, and should always be considered.

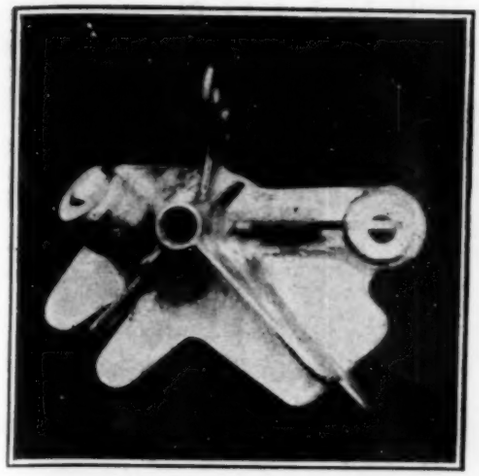
However, we should not be led to believe that the expense of a polished surface is justified on parts of a fixture where a painted surface would meet the requirements, as far as the efficiency of the fixture is concerned. Paint will protect it from rust as well as add to its appearance. In many cases it is preferable to a finished surface as well as more economical. Although the practice is not common, many fixtures are adaptable to paint on more or less of their surfaces.

—JOHN MARK MAY.

Holding Back on Piece Work

IT IS the exceptional man who works for the sheer love of working, who takes pride in seeing how much he can turn out in a given period and does not think of the consequence of increasing his production over a certain amount. When such a man does crop up among the personnel of a factory, he is likely to be quickly "called down" by his mates, told that he is "killing the job," and warned that he had better lay off the "speed merchant stuff." If he disregards the warnings, steps are taken to see that his production is cut to "reasonable" limits. If this is not possible, his life is made miserable by a thousand petty devices. He is finally compelled to quit his job, or cut his production to suit the ideas of his fellows. It may be that some executives will question the truth of this statement, but every workman in the shop knows in his heart that it is true more often than otherwise.

As for concealing work done above the normal daily quota, this practice is common in every shop where piece work prevails, and where steps are not taken to prevent it. This again, is only human nature. People are not always up to normal, and workmen, knowing that their pay envelope will be allowed to contain about a certain amount, naturally wish to keep their earnings as near the maximum as possible. In order to insure this, they "hold out" on good days to make up for their losses on bad days. There is nothing really dishonest about this, as, over a period of time, their production averages normal, and the firm gets this normal rate on which they are counting. —E. M. PIERCE.



Welded Fittings for Metal Airplanes

By Fred H. Colvin
Editor, American Machinist

Fixtures, apparatus and methods used in producing fittings and some assemblies for modern metal airplanes

WELDING fixtures play an important part in the construction of the various fittings used by the Glenn L. Martin Company in the production of its all-metal fuselage and other airplane units. Such assemblies as the engine mount, cockpit opening frame, and such units as the interplane strut fittings and wing hinges are built up by welding.

Beginning with Fig. 19, it is seen how these pieces are held for welding and the way in which they are built up from small parts into a complete whole. In Figs. 19, 20 and 21, the main part of the fitting is a steel stamping to which has been welded numerous fins or webs and other projections, some of which fit into the openings in the Eureka sections and enable the struts and fittings to be riveted into a solid assembly.

Some of the fixtures are progressive in that a part of the fitting will be made in the first fixture, the partially completed piece then going to the second fixture, and so on, until the piece is completed. Each fixture checks the angles and positions of the different parts so that the completed piece will fit into place in the final assembly without difficulty, this being a very important item in the successful fabrication of airplane body structures.

The third and concluding part of the article.

An examination of Fig. 20, shows how the fixture holds some of these parts in position while they are being welded. It also shows locating points and clamps that will be used in holding other pieces in position as the work progresses. This fitting connects the fuselage to the interplane strut fitting and is an extremely important member of the whole structure.

Close tolerances are necessary on all these fittings, both as to angles and as to the location of the various holes, so the fixtures must be carefully made, and the completed fitting inspected critically before going to the sub-, or final assembly. Some of the welding fixtures are also used for drilling by incorporating drill bushings at the necessary points.

A group of substantial fittings can be seen in Fig. 25. These are wing beam hinge fittings, and must not only be accurate, but also of ample strength, and absolutely without flaw. On them depends the safety of the airplane, and when the plane is fully loaded, these hinges are subjected to severe stresses. They hold the wings on the fuselage, and at the same time permit them to be folded back parallel to the fuselage in order to economize space in storage.

Two other welding fixtures are shown in Fig. 26, these

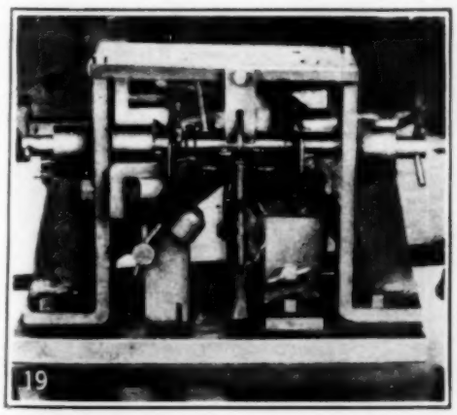


Fig. 19—A fitting for assembly between the upper fuselage and the interplane struts, and the fixture in which the numerous parts are assembled and held while they are being gas-welded together. The advantage of being able to unite such a large number of parts in a single unit can hardly be over-estimated

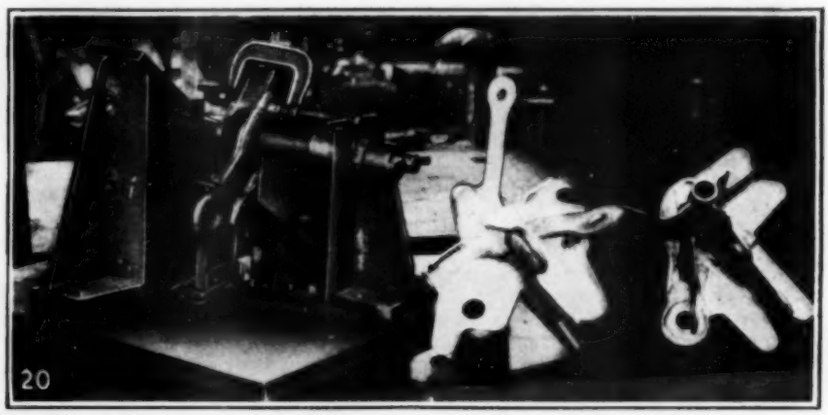


Fig. 20—Fixture for assembly of the fitting that joins one of the interplane struts with a longeron, or horizontal member of the fuselage

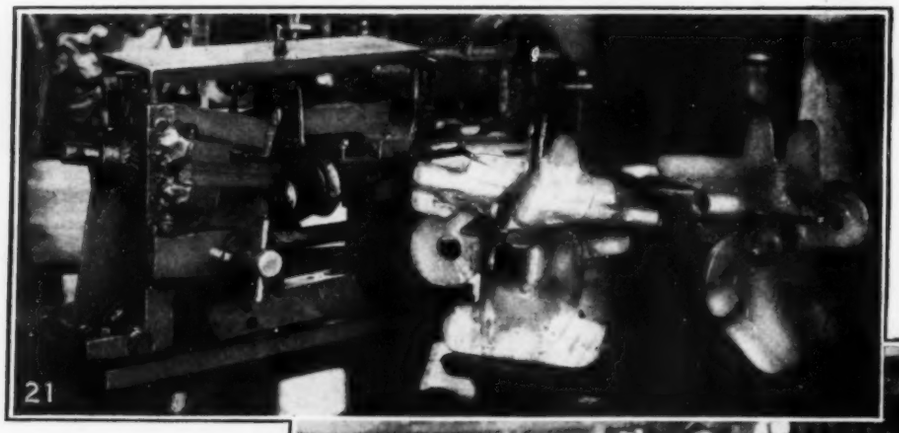


Fig. 21 — One of the lower fittings that attaches the lower inner wing to the fuselage. The fixture shows how the different pieces are held in position and welded, and suggests what can be done in fixture as well as in part design when the need arises

Fig. 22—A tail-skid bracket in process. This illustration shows the partly assembled unit at the right built up from a main tube, a small cross tube and other stampings, and the fixture holding these parts in place while the other members are added to make the complete fitting shown at the left

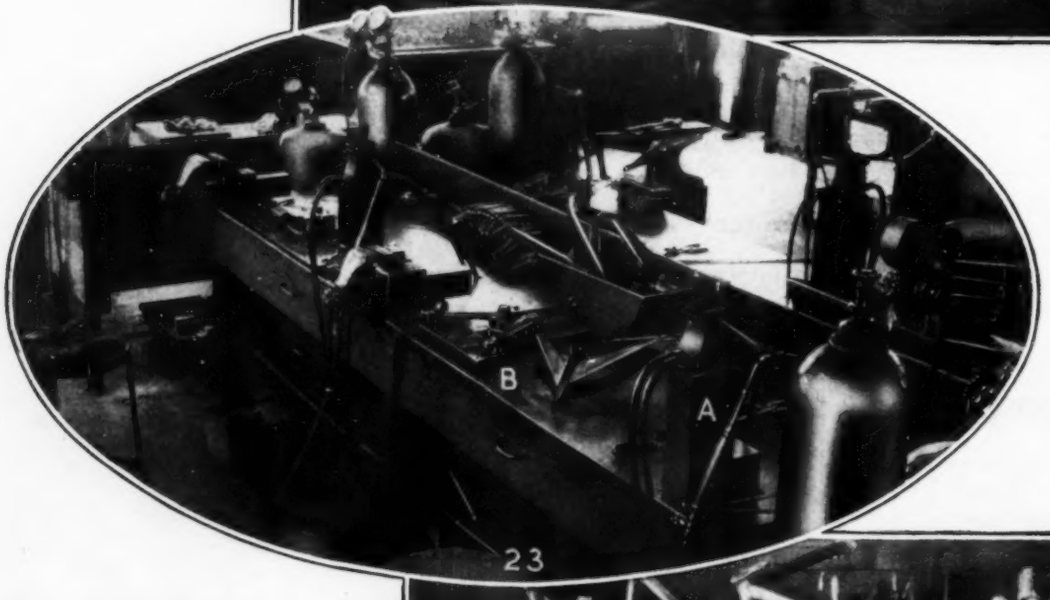


Fig. 23 — A section of the small parts welding department showing two of the welding benches, the location of the gas tanks, and the hooks for holding the torches when not in use. The hooks cut off the gas supply when the torches are rested in them. Another of the fittings and its fixture are shown on the bench

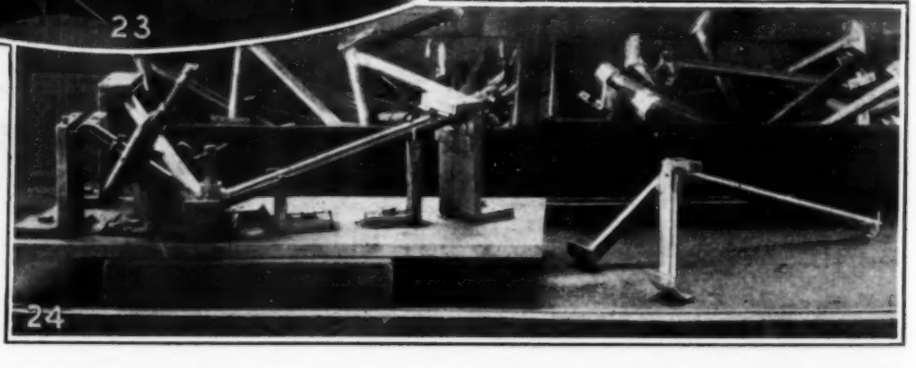


Fig. 24 — The arresting gear retrieving control bracket is made up of tubing. The illustration shows clearly how the piece is held in the fixture while the different units are being welded together. The method of locating the short shoes on the ends of the tubes by using pins and removable caps makes it easy to place them in position

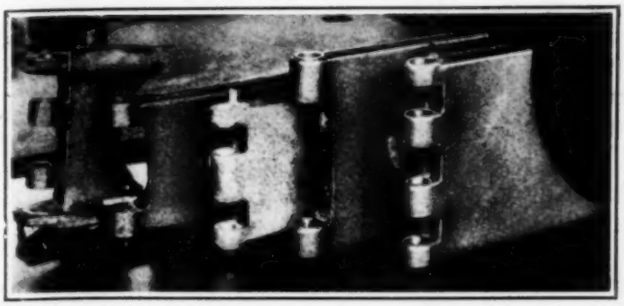


Fig. 25—Hinged fittings for the upper and lower wing beams that carry the outer wings

Fig. 27—Cowl framing for the two cockpits

being for engine mounts and cowl support rings. The illustration shows how the various members of the engine mounts are held in position during welding. The same

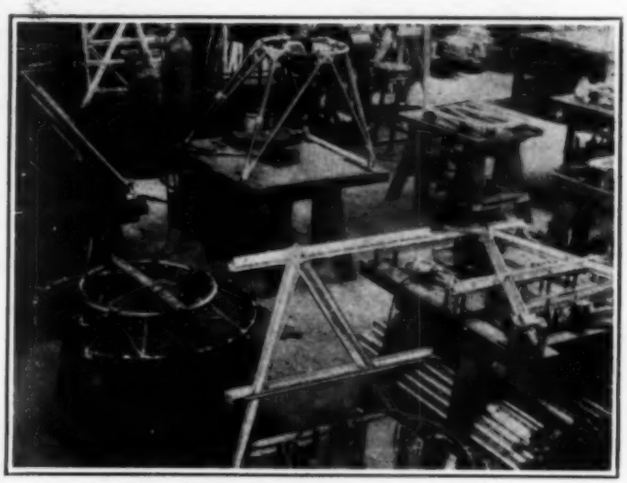


Fig. 26—Assembly benches for the engine mount and some of the units of the fuselage construction

illustration also shows some of the fixtures for assembling parts of the duralumin structure and shows the contrast between the two methods.

Still another example of welding fixtures is shown in Fig. 27. This is a large fixture that handles the cowl framing for the two cockpits in tandem. It is no easy task to assemble all of the tubes that go to make up this structure and to hold them in correct alignment during the welding operation. For this reason it is necessary to have a very substantial fixture. In addition to the main joints, it is also necessary to weld a row of eyes on each curved member, for attaching the leather upholstering on the edge of the cockpit. The completed cowl unit shown on the floor beside the fixture gives a good idea of the number of joints required and the necessity for an accurate and substantial fixture to hold the parts while being welded.

No Christmas Presents for Purchasing Agents—*Discussion*

By Joseph Bell

THE editorial on page 1006, Vol. 69 of the *American Machinist*, brought out a very interesting point. A salesman often makes the purchasing agent a present of some article in order to influence a sale. While a certain amount of social intercourse between the purchasing agent and the vendor's representative may be allowable, the practice of making gifts to a purchasing agent is reprehensible. The company, which has the right to every concession in price, does not get the favor. It is simply an inducement to the purchasing agent to purchase from a particular house, or in larger quantities than the company can readily use or sell.

Fair dealing between buyer and seller would be more universal, and the ethics of the buying profession would be at a higher level, if every company took the stand of not allowing its purchasing agents to accept gifts from salesmen, and discouraging its own salesmen in making any moves in the direction of favoring the purchasing agents with whom they have dealings.

However, purchasing agents who are conscientious are not interested in gift-bringing salesmen and they handle the situation diplomatically by putting the salesmen "wise" to the fact that goods are bought on their own merits, and that presents are unnecessary.

The salesman who gets orders by giving the purchasing agent presents is inviting doubtful comment on the quality of product he is selling. Some salesmen feel that they cannot "mix" with the buyer unless they show him attention in the form of presents. Many buyers dislike to do business with "friends." The salesman in attempting to worm his way into the confidence of the buyer by giving him gifts is trying to show him that he is his "friend." However, in buying, every man is out for his firm, and its interest must come first. The efficient buyer keeps friendship out of consideration, and buys primarily for quality and price. He can easily make it understood by the salesman that he considers the practice of making gifts to be opposed to the welfare of his firm.

Salesmen will find that they can get the confidence and good will of the buyer by finding out what he needs, and satisfying those needs.

Railroad Shop

Photographs by Courtesy of the

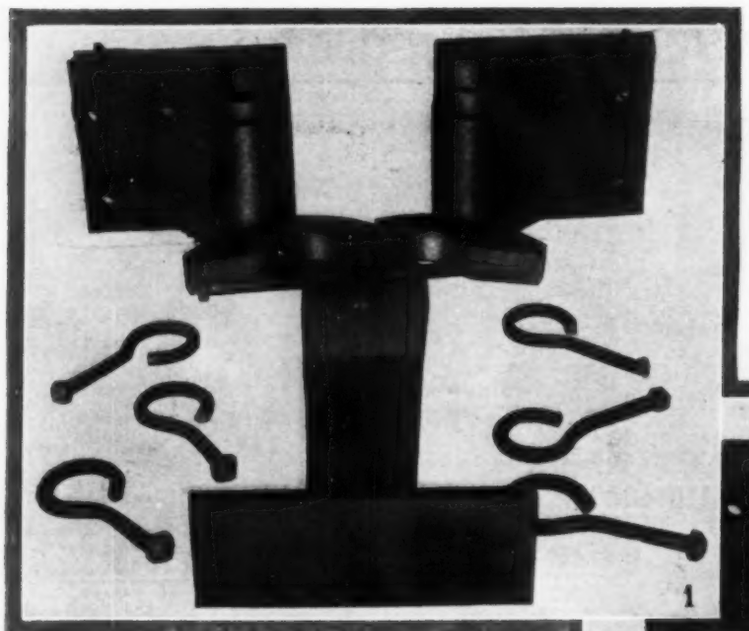


Fig. 1—Bending die for uncoupling lever hooks for freight cars. This shows the beginning of the operation with the bar to be bent located against the right-hand bending arm. The forward movement of the bulldozer ram forces the arms between the rollers, and forms the hooks shown

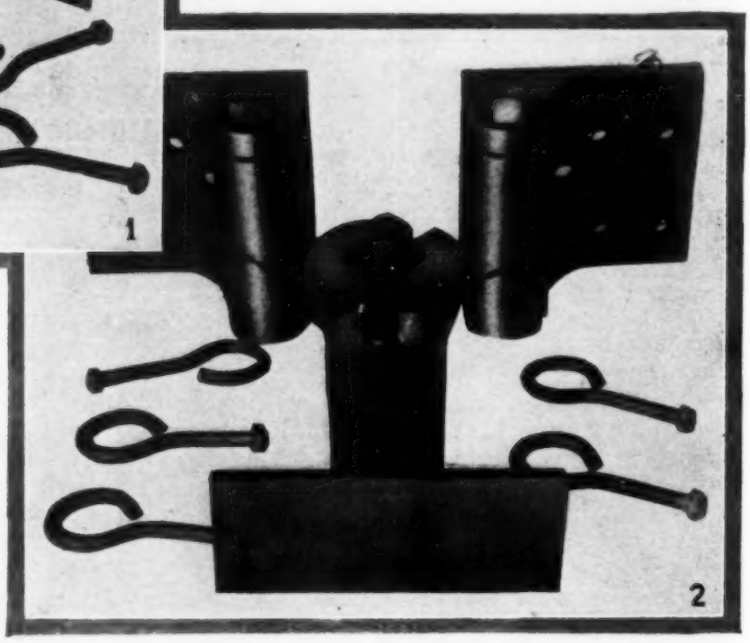


Fig. 2—Showing the arms passing between the rollers and forming the hook. The square end of the shank projects as shown. The chain on each arm pulls it open on the return stroke of the ram, so that the operator need only insert the blanks, and remove the hooks after bending

Fig. 3—Bending brake beam clips to shape in one operation. The blank is laid across the opening in the die, and the plunger forces it in as shown. As it nears the bottom of the stroke, the end of the plunger strikes the arm *A*. As this arm turns, the short end comes in contact with one side of the work and forces it into the opening in the side of the ram, completing the clip. On the return stroke, the lever *A* is re-set automatically in the position shown

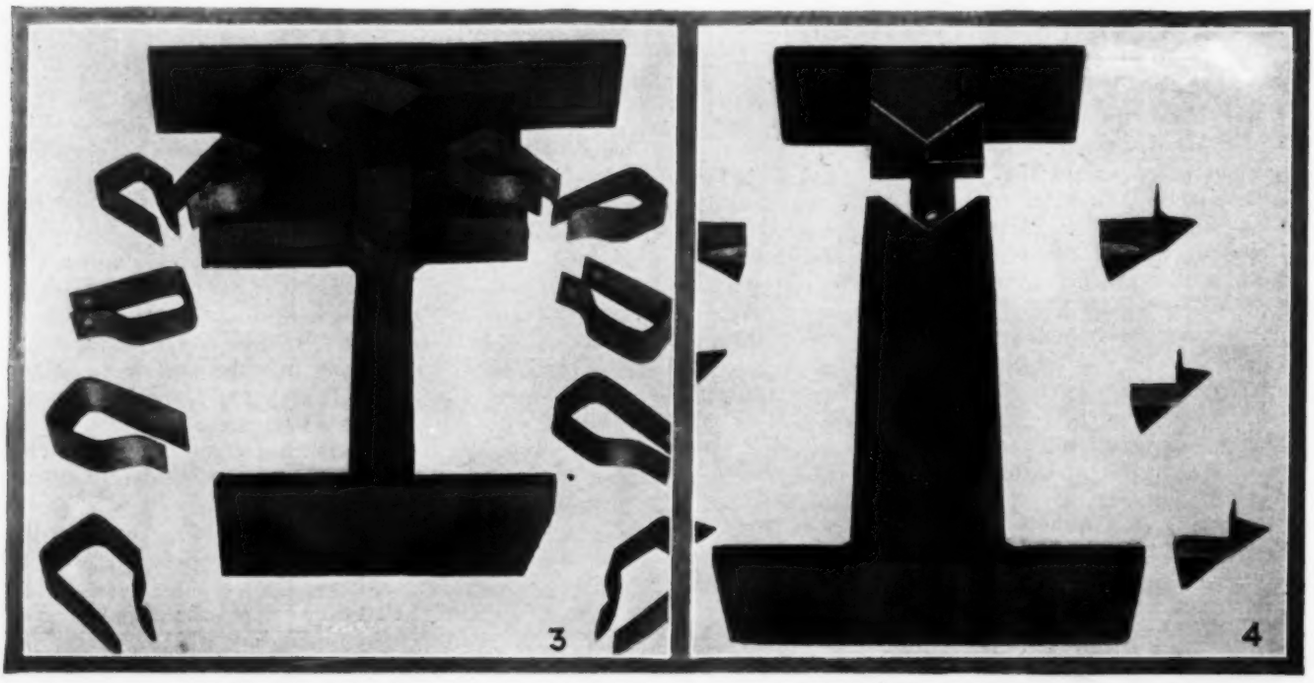
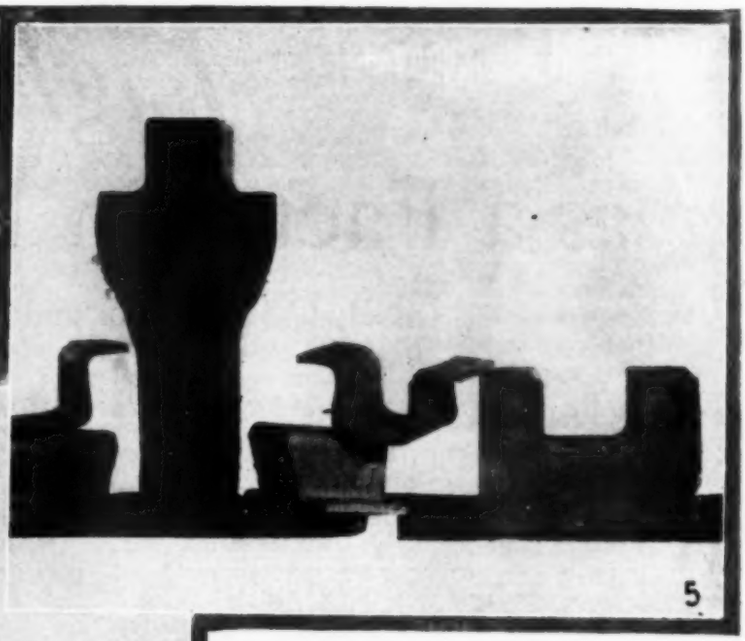


Fig. 4—Dies for forming what are called spray nozzles that are used on the overflow pipes of injectors. This is a simple forming operation with a blank that has been stamped to the proper shape in a previous operation

Bulldozer Dies

Canadian National Railways, Moncton Shops



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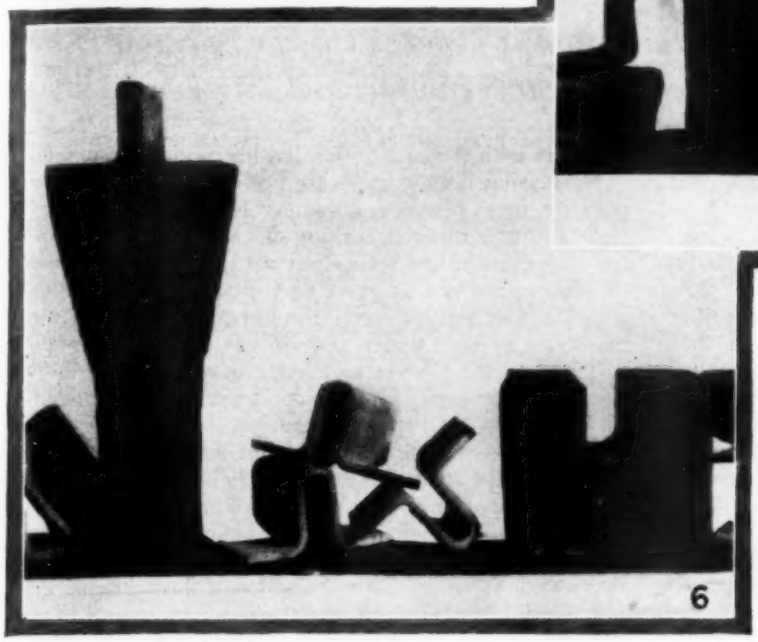

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Fig. 5—A simple forming die for hold-down housings, used in connection with spring frogs, by the maintenance of way department. The formers are roughed out from bar stock with the cutting torch, and are inexpensive to produce

Fig. 6—Another hold-down bracket for spring frogs in the maintenance of way department. Here again, both punch and die are of simple construction, are roughed out with a cutting torch, and welded to backing plates by which they are positioned in the bulldozer

Fig. 7—A combination forming and cutting-off punch for making right-angle bend brackets used largely in passenger car work. A strip is fed in, as shown, and a single stroke cuts it off and forms the bracket as rapidly as the machine will operate. Fig. 8—Forming die for floor rack brackets used in refrigerating cars. These brackets first receive a right-angle bend in a previous operation. One leg of this angle is placed in the slot shown in the die. The rest of the forming is done at the rate of about 700 pieces per day. Both punch and die are welded to baseplates

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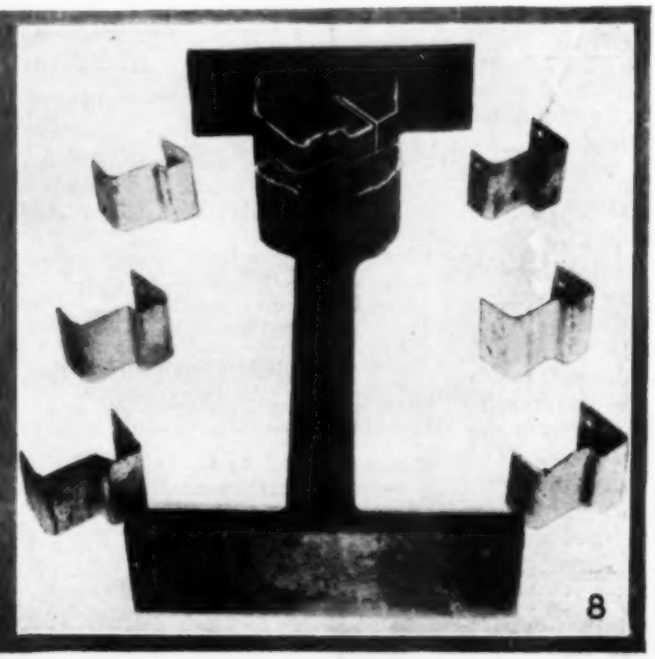

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Light as a Factor in Production

By C. C. MUNROE and H. A. COOK
Lighting Service Division, The Detroit Edison Company

Adequate and uniform intensity of illumination is necessary if the operator is to perform his duties with speed, accuracy, comfort and safety

WHEN thinking of production we unconsciously visualize large industrial areas, numerous factories, wheels turning, machinery operating, and men and women engaged in manifold operations, each playing an important part in an organization designed to manufacture or produce some definite object or thing of value. It will be noted that the last part of our picture is that of men and women engaged in these operations. This has unfortunately been the last consideration in industry in times prior to the present, and the result has been a distinct economic loss to industry at large and a source of grief to workers in particular. It is the object of this paper to deal with the question of light as a factor in production, and inasmuch as machinery is not generally dependent upon light for the production of materials, the discussion will center about the effect of light upon production as it influences the operations carried on by men and women in industry.

If we analyze some of the factors upon which lighting has a distinct bearing, they can be classified into two general divisions as related to production. These are the direct effects and the indirect effects.

The direct effects are produced by the operators' greater ability to see when the lighting is adequate, and the indirect effects are those which influence such items as accidents, spoilage, labor turnover, and health. We shall first concern ourselves with the direct effects.

DIRECT EFFECTS

Let us for a moment consider the adequately lighted plant. The intensity is sufficient to enable the operator to perform his duties with speed and accuracy. He can proceed with his activities with the confidence that his motions are correct.

No glaring light sources are present to blind him temporarily, or to produce undue eye fatigue. His vision is clear and unhampered, making efficiency possible. Spotted illumination has been eliminated, so the adjustments of the eye are not as great as formerly, thus making it possible for him to work throughout the day without the strain present under adverse conditions.

These factors, while seeming elementary, have a distinct and pronounced bearing upon the quantity of materials produced by workmen.

An analysis of the reactions that take place under the conditions specified for adequate lighting will establish facts of importance to efficient production.

Intensity. We shall first consider the effect of intensity upon vision. If an ordinary eye-testing chart is viewed from a distance under a low intensity of illumination the limit to which accurate reading is possible can easily be determined. When the same process is tried with a higher intensity of illumination upon the chart, it is invariably true that letters of a smaller size can be correctly read at the same distance. This would indicate that we can see better and more accurately when a higher intensity of illumination is used.

Another experiment can be performed by observing a rotating cylinder with printed matter on it and noting the effect produced when the intensity is varied from low to high. Although the cylinder is rotating at a constant speed, it apparently slows down when the higher intensity is used and speeds up when it is decreased. Such a result is obtained because the eye reacts more quickly under the higher intensity, which in turn produces the

Comparative Production with Old and New Systems of Factory Lighting

Shop	Average Foot-Candles with Old System	Average Foot-Candles with New System	Increase in Production with New System Per Cent	Additional Lighting Cost, Per Cent of Payroll
Pulley finishing (Pyott Foundry Co.)	0.2	4.8	35.0	5.0
Soft-metal bearing (Foote Bros.)	4.6	12.7	15.0	1.2
Heavy steel machine (Lee Loader & Bondy Co.)	3.0	11.5	10.0	1.2
Carburetor assembly (Stromberg Carburetor Co.)	2.1	12.3	12.0	0.9
Plant manufacturing electric, gas, and sad irons (Dover Mfg. Co.)	4.0 at tool point	13.5	12.2	2.5
Semi-automatic, buffing brass shell sockets (General Electric Co.)	3.8	11.4	8.5	1.8
Manufacturing piston rings (Detroit Piston Ring Co.)	1.2	18.0	25.8	2.0
Letter separating (U. S. Post Office Dept.)	3.6	8.0	4.4	0.6
Inspection in roller-bearing plant (Timken Roller Bearing Co.)	2.0	20.0	12.5	25.0
Average	2.36	12.5	15.0	1.97

Abstracted from a paper presented at the annual meeting of the A.S.M.E., December 3-7, in New York.

sensation of a decrease in the speed of rotation of the cylinder. A logical conclusion can then be drawn to the effect that moving or stationary objects are more clearly seen under a high intensity of illumination than under a low one. This is of the utmost importance in industrial operations where moving parts are so prevalent.

The higher intensities of illumination, then, make it possible for individuals to work with greater speed and accuracy because of their ability to see better and more quickly.

Glare. The second requirement to be met in order to produce adequate illumination is the elimination of glare. Glare can be produced by bright light sources or reflections in the field of vision, or by excessive contrasts in intensity. It may be from the light source itself, if an artificial one is used, or it may be due to particular conditions in the general industrial area that produce the marked contrasts which are uncomfortable to the eye.

One marked result produced by bright light sources in the field of vision is that they will make clear vision and observation of detail difficult if not impossible. This can easily be demonstrated by lighting a modern incandescent lamp in an area of comparatively low intensity. If a person looks at the light source for a short period of time, and immediately after attempts to distinguish objects or details he finds that it is impossible to do so clearly. After the eye has adjusted itself to the lower brightness, however, clearer vision is again possible.

The temporary blindness thus created naturally decreases a person's ability to perform his duties quickly and accurately, to say nothing of the possible injury to the eye itself. In order to continue to work at a normal speed, therefore, glare must be eliminated whether it be direct from the light source or reflected from some other surface to the eye.

Distribution. Our third requirement, uniform distribution of light, is important because of its bearing upon the elimination of sharp intensity contrasts and consequent elimination of glare, to say nothing of its importance in accident prevention and sanitation.

From the simple experiments mentioned and the general conclusions drawn, it would seem reasonable to expect an increase in the working efficiency of a man, provided the lighting conditions outlined under what is termed "adequate" lighting prevail. This in turn should result in an increase in production, if an entire plant were properly lighted. If the operations were automatic to a great extent, however, the production increase would not be of the same magnitude as if they were almost entirely manual. But in either case an increase should be produced.

Based upon the foregoing conclusions, tests have been conducted in various plants in an effort to determine what actually happens when theory is applied to practice. These tests have been conducted in such a manner that they may be taken as criteria of what occurs. They include the keeping of records regarding the production obtained when using the old lighting, and similar ones after the new lighting system has been installed. The comparative figures obtained represent, as far as is practical, the difference between the conditions obtaining under each system. In the accompanying table a summary of several tests conducted in such a manner is given.

From these tests it is evident that an increase in production is obtained by employing the new system, the average increase reported being approximately 15 per cent. It should be borne in mind that no additional machinery, floor space or supervision has been used. The only additional expense has been the cost of the new lighting system.

From records compiled during these tests and from the cost of the systems installed, the cost of the new lighting, in terms of the payroll cost, has been determined, and this in turn compared with the increase in production. Analysis of these figures shows that the desirability of providing adequate illumination in a factory cannot be reasonably contested, inasmuch as the general average arrived at reveals an increase in production of 15 per cent with an increase in lighting cost amounting to approximately 2 per cent of the payroll cost. A distinct advantage is to be obtained without further increase in plant equipment, also a marked advantage when the highly competitive markets are considered and the importance of producing materials at the lowest possible cost consistent with good quality is paramount.

Indirect Effects

Progressive executives are at the present time giving serious consideration to the safety of their employees, to the question of labor turnover, to the general health of those under their supervision, and to that bugbear of manufacture, spoilage. Let us, then, determine whether or not the question of adequate lighting may be a factor in these problems.

Upon investigation, it is found that the greatest number of accidents occur during the winter months—in fact, there is an increase of approximately 100 per cent as compared with the summer months.

Estimates furnished from insurance reports attribute 15 per cent of all industrial accidents to defects in lighting. It might not be quite clear in what manner the inadequate lighting is responsible for the injuries sustained. Several examples, however, will remove any doubt regarding this question. These examples follow:

Typical Accidents Due to Poor Lighting

(*a*) An unshielded drop lamp is hanging low over a machine. The workman glances at the bright filament and is temporarily blinded. He reaches for a belt shifter and instead takes hold of the belt. The result is a lacerated hand, the sole cause being poor lighting.

(*b*) Quoting from a paper presented by R. E. Simpson, a representative of the Travelers' Insurance Company, before the Illuminating Engineering Society: "A workman was hurrying down a dim passage through a store room. Some bar steel was piled at one side, one of the pieces projected beyond the others; he did not see it, and with full force ran it in his eyeball, permanently losing the sight of the injured member." Again an accident directly caused as a result of improper lighting.

Accidents caused by stumbling over materials concealed in shadows, shadows on moving parts of machinery, and other examples can readily be traced to a violation of the principles outlined for obtaining proper illumination. How does this phase of the question influence production?

Each time an accident occurs there is a loss of time due to the temporary discontinuance of production; there is an added expense for doctors' services and compensation placed upon the management which must eventually be charged in the costs of manufacture; there is the disturbance of the morale of the other workers, this being especially true when working conditions are none

too favorable throughout the plant; and above all, there is the bodily injury and suffering which the unfortunate workman himself must undergo.

The importance of this phase of the question can better be appreciated when the inadequate lighting is charged with an annual cost of $2,000,000,000 for the payment of compensation claims and the indirect losses suffered by the manufacturers of the United States. Forgetting the humanitarian side of the question of safety, the economic side demands every executive's attention since this expenditure is a direct levy upon capital and an important factor in the determination of production costs.

Again quoting Mr. Simpson, we learn that:

> A manufacturing concern employing an average of 1,000 workers had an annual payroll of $1,750,000, and paid a yearly compensation premium of approximately $22,000. For some time the annual number of accidents (many of them minor, none of them fatal) was approximately 425. The compensation payments and medical fees averaged nearly $15,000 per year, or about $35 per accident.
>
> The entire lighting system of the plant was revamped by substituting large lamps with approved reflectors in place of the original lighting equipment, and locating the units in a proper manner with respect to the work. The electric-current consumption was increased from an average of 40 watts per employee to 100 watts per employee. The contract for the electrical work was $5,000; and the annual lighting bill increased from $1,900 to $4,700. The accidents, however, dropped from an average of 425 to 170, and the compensation payments were reduced to approximately $6,000.

Approximately half of a workman's waking hours are spent in the performance of the duties necessary to bring him a livelihood. Would he rather spend these hours in poor or pleasant surroundings? The answer is obvious.

Quoting Mr. Simpson, we learn that:

> Under normal conditions, 25 per cent of our physical energy is expended in seeing things—making use of our sense of sight; 70 per cent of our muscular actions are in response to impressions gained through our sense of sight; two-thirds of our workers have defective vision to an extent that requires them to expend more than 25 per cent of their energy to approximate normal vision under good lighting conditions.

If, then, these statements quoted are fundamentally true, we can readily appreciate the manner in which our nervous system, and in time general health, can be impaired with improper lighting as one of the major contributory causes.

A survey of a large body-making plant which installed lighting equipment sufficient to provide illumination of a very high order shows that the saving in spoilage on one operation amounted to $30,000 for one year. This saving is credited directly to the lighting because the only change instituted that could produce such a saving was the improvement of the illumination.

Does Lighting Receive Sufficient Attention?

A recent survey of 20 Detroit industries indicated that approximately 35 per cent of the electrical energy consumed is used for lighting and 65 per cent for power. No doubt great care is taken in the selection of the motors and equipment used for the manufacturing processes, efficiency being the determining factor. It is questionable at times whether or not the same care is taken in the design of the lighting system. If this item is not given careful consideration, it simply means that 35 per cent of the energy expense is not being applied efficiently and the plant accordingly is not being operated on the most efficient basis.

If, however, the lighting is considered as an asset to be used to best advantage, ample returns will be paid upon the investments made in the proper application of this asset.

SEEN · AND · HEARD

By John R. Godfrey

Shop Instructions— Planer Drives That Will Stop

According to production managers who ought to know, a large percentage of spoiled work is due to the worker not being well instructed as to the job to be done. One great trouble seems to be that few of us are good teachers. No matter how well we know the job ourselves, it is the ability to make the other fellow know it that counts. Knowing how ourselves we overlook little details that seem self-evident but are not. If we ask the man if he understands, he knows we will think he is ignorant if he doesn't, and he usually says "yes," whether he does or not.

Someone has said that a good teacher must be able to make work attractive so that the learner will want to do the job and do it right. Most of us tire of the repetition and lose interest, hence we fail to impart interest to the learner. Teachers need to be good actors so they can show enthusiasm day after day.

Another serious handicap of the average teacher is that he forgets how dumb he was as a learner, and loses patience when the new man overlooks some point that he has probably not made clear. Then too we are all inclined to teach the thing we learned last, instead of leading up to it in proper sequence.

There seems to be little doubt that proper instruction has its place in every plant. The larger the plant, where the failure of one link in the production chain may tie up a line of important items, the more necessary the instruction. Here is another place where tact, and the ability to co-operate with foremen is of vital importance. For the teacher must supplement the foreman without interfering with him.

* * * *

Electric planer drives are now far too common to cause comment. But a happening awhile ago called them to mind forcibly in one shop. Armistice day was to be celebrated by stopping all activities for a brief period. So, instead of blowing a whistle with its attendant confusion, the orders were to pull the main power switch and so stop all the machines at once.

It was a simple and satisfactory method except for one planer, which had just got well under way on the return stroke. The table with its work forgot all about Armistice day and kept right on going until an overhanging part of the casting hooked into the housing and stopped with a bang. For this particular mechanism had no brake that operated when the current was off—depending on the current to apply the brake when the table dogs came into action.

Just what was said or what the damage in dollars amounted to, is beside the question. The need of a prompt change in the design of this particular apparatus is apparent. And it is a great commendation for the reliability and continuity of the power supply that the same catastrophe had not occurred during the time this particular planer drive had been in operation in other shops as well as in this one.

Production

With Standardized Units

Discussion

Taylor Plan Sure to be Adopted Some Day

By Lucien I. Yeomans
Consulting Engineer

SOMETIMES it is as difficult to select a properly descriptive designation for new things as it is to conceive them, and the methods so ably described by Herbert E. Taylor are worthy of a more appropriate designation than "unit continuous system of manufacture." There are too many other methods which might be properly so designated. This plan of manufacturing is certain to be widely adopted, as time passes, and is entitled to be properly christened in infancy.

As Mr. Taylor points out, it is not entirely new and some installations have been under way in this country for about ten years but are not widely known. In fact, such installations as have been made along this line here have been classified as special machinery, which is equally a misnomer.

This writer can suggest no suitable name, but can distinguish the difference between such equipment and special machinery clearly enough and can point to some already available elements of prime importance, for such constructions, that are more or less standard now.

Many standard machine tools of today were the special machines of yesterday and we will see standard elements, in the way of various machine heads for a variety of work, adapted to be built into such units just as soon as a demand is created. As Mr. Taylor states, it is possible to obtain standard electric motor elements now. It is also possible to obtain standard drilling head elements, either single or multiple. Standard tapping and die threading elements require little alteration to adapt them to this use.

The motions necessary to time and position the various elements as well as to actuate them are those which are usually least capable of adjustment, in special machinery, and, in such machinery, most often derived from cam action, clutched gears, screws and nuts, square or splined shafts, rack drives, etc. These elements will not be depended upon for actuating such machinery as Mr. Taylor describes and will appear as intermediaries, if at all.

It is evident that Mr. Taylor has it in mind that these motions will be derived from the operation of electrical elements, principally, and there are plenty of such elements available. There would be required a standardized timing element, which would be fully adjustable in every respect and be driven, preferably, by a synchronous motor. It would time the controls for the entire unit, regardless of what means was adopted to actuate the elements. The positioning and return to normal of a working head, or the operation of a feed, is no different in requirement from the opening and closing of a gate valve and standard equipment for that purpose, electrically or hydraulically operated, is available. There are also available hydraulic elements, such as the "Oil-Gear," which are particularly adapted to such use and are perfectly standardized now.

Herbert E. Taylor's article, "Production with Standardized Units," published in Vol. 70, No. 1, has excited considerable comment from American production executives and machine tool engineers. We begin here the publication of some of it. The rest will come later

As Mr. Taylor says, his second stage has been reached in some of the station-type machine tools, not alone on a small group of operations but in some cases on widely different operations, completing a quite complicated part. Small machines of this type have had a place in the manufacture of sewing machines for many years and a prominent machine tool builder produced, a few years ago, from a customer's designs, four machines of station-type which were of such magnitude that they cost approximately a hundred thousand dollars each, erected. These machines finished all of the quite difficult machining on the part, consisting of face milling, straddle milling, drilling, reaming, tapping, end milling, and counterboring. The milling on some parts was in nine different planes and the drilling was cross, vertical, and angular. These machines were sufficiently adjustable to machine any desired part of the type for which they were intended. They were of the true station-type machine in which the work is loaded and unloaded at one point. There is a fully automatic, self-feeding and discharging, station-type machine in Chicago which drills, reams, faces, chamfers, recesses, and thread mills nuts—the nuts having a special thread variation which cannot be tapped.

These machines are illustrations of equipment on the border line between special machines for a single-purpose and the elastic general-purpose units Mr. Taylor advocates.

There are other machines in operation here which more nearly meet his ideas. They are progressive station-

type machines with the work received at one end and progressively machined in various ways at different stations until it is delivered, finished, at a point remote from the starting point.

An eastern machine tool builder built such a machine, from a customer's designs, which is a couple of hundred feet long and performs shearing, milling, punching, drilling, reaming, assembling, and riveting operations.

This unit quite closely approximates the ideal of Mr. Taylor. It progresses work of considerable size, step by step, to stations where the various operations are performed by machine elements which are standard for this shop and adjustable for any work they do.

In designing such units as are suggested by Mr. Taylor the essential elements are—

(a) Standardized machine heads for various operations, independently power driven

(b) Standardized positioning means for placing the heads in working relation to the work and returning them to normal

(c) Standardized gaging heads for automatic inspection

(d) Standardized conveyor elements with automatic doweling means for accurate location and clamping, at operating stations

(e) Standardized, sectional, base units.

The elements (a) are not now available except for the few purposes already noted. The (b) elements are now available, as pointed out. The (c) elements would always be special for a given product, except for variations in dimension of similar work or the simplest operations. The (d) elements could be selected from the possible combinations already standardized by the oldest and best makers of conveying machinery. For the (e) elements we would expect a great diversity of opinion among designers. This writer would consider structural steel satisfactory, and some standards could be selected from sections already available, although beams with thicker flanges than are available, to permit finish, would be desired. Accurate locations of both the work and operating heads, etc., would be secured by the suggested doweling and clamping, in any case.

We have, in this country, certain machine tool manufacturing plants whose resources are practically unlimited, but their high accomplishment is in the past and not the present. Such a plant has an opportunity to stage a "comeback" in the development of these proposals, and, by adding to their organization a man who, like Mr. Taylor, has a "vision of a time when there will be such a demand for these standardized units that the builders will use them in their own shops" could make a study of the possibilities and regain their former position of eminence. Whole-hearted confidence in the ultimate success of the plan, plenty of "vision," courage enough to meet discouragement, and the ability to disregard the conventional and accomplish the desired result with great simplicity, regardless of precedent, are the qualifications such a man must have to direct this performance successfully.

We have taken too many short steps, successively, in the design of production machinery. All of our great industries exemplify this. The wonder is not that steel mill manufacturing has reached its present point of perfection, but that it took so long to get there; not that our automatic screw machines have such a high production, but that there were so many steps between them and the hand machine; not that our railroad operations are so satisfactory, but that their development has been so slow that the fastest trains between New York and Chicago have a slower schedule than they did twenty-five years ago and their equipment has improved so little in that time.

The Trend in the United States Is Definitely Away From Special Machines

By Ralph E. Flanders
Manager, Jones & Lamson Machine Company

MR. TAYLOR'S article, "Production with Standardized Units," is highly stimulating, and it is interesting that the idea has been developed to the extent that it has been, not in this country which is supposedly the home of continuous production, but in England where the opportunities for elaborate manufacturing schemes of this sort are not supposed to be quite so good as with us.

In the first place, it may be well to call attention to developments of a similar nature in this country. One of these worked out many years ago is in the manufacture of various watch parts as developed by Mr. Church of the Waltham Watch Company. His arrangement (applied to many parts and many different kinds of operations) consisted of a series of small one-operation machines strung along a bench, with the provision of transfer arms to take the part out of one machine and put it into the next in the series. The blank parts were either cut from the rod in the first machine or taken from a magazine, and were finally placed in a finished work magazine at the end of the line. As the writer remembers the scheme after the lapse of some thirty years, it was a fascinating sight to see the transfer arms all moving at once at the completion of a dozen or more operations performed on separate machines. There are a number of products that come to the writer's mind which would seem susceptible to the same method of manufacture.

Another similar case is to be found in an American automobile manufacturing plant where several operations connected with gear cutting and finishing are performed in work spindles which travel successively past a series of machines. This machine has presumably been successful, but the writer does not know of any other plant where it has been installed.

Coming to the English installation, the large scale in which the scheme is carried out raises a number of questions. If the operations on the piece are to be widely varied, the separate units will either have to be built by separate firms, or by some firm building a wider range of machinery than is common with most machine tool builders in this country. Possibly it could be done by a group of machine tool manufacturers working together toward a common aim. The design of units suitable for such applications which, at the same time, would have a wide enough general use to be built in volume great enough to be sold at a reasonable price, is in itself a problem of considerable difficulty.

The question at once arises as to the rapid change in design of automobiles and as to the ability of such an elaborate layout to adapt itself to these changes. An earlier tendency in this country toward highly specialized machines received a severe check when it came to be

realized that design changes were not to be occasional and minor, but were to be regular and radical instead. This has led production managers of most automobile shops to a decision in favor of standard tools designed for the application of special equipment which transforms then into special machines for a given part, but permits them to be changed over for other work at not too great a cost. The cost of changing over such a layout as that shown by Mr. Taylor might be prohibitive.

There are, of course, some machines already built in this country which adapt themselves to this scheme. Several of the automatic drilling machine manufacturers, for instance, make complete, self-contained units. Possibly the general tendency of machine design may work around in a direction to make conditions more favorable than now appears.

On the whole, it would look as though Mr. Taylor had developed an idea to its extreme limit and was trying to put it into practice. The safer way is to take a practice previously developed to the extreme limit, and develop it a step further in advance, at the moment when a change in conditions makes that development profitable. Has there been any such change in conditions?

Bigger Savings Possible Through Study of Assembling and Shop Management

By R. R. Keith

Manager, Tractor Works, J. I. Case Threshing Machine Company

IN THIS discussion, the thoughts presented are those arising from a discussion of Mr. Taylor's plan with our chief tool engineer, O. L. Lewis. It appeals to me that any problem of this nature must first be analyzed very carefully, and the methods applied to the production of any particular piece adopted only after certain fundamentals have been set down with respect to each article. Among these things requiring study are the following:

First, the quantity to be produced per day

Second, the quantity to be produced before the design becomes obsolete

Third, the accuracies required in the several operations

Fourth, the possibility of combining standard equipment or semi-standard equipment so that the obsolescence of the article being produced will not completely necessitate the charging off of the equipment chosen.

With this study having been completed, then the planning department should know—in fact, must know—what equipment is available in the machine tool field for producing the parts in question. In general, some eight years ago it was very popular, I think largely because Ford made it so, to combine in complex ways various necessary operations on a single piece. That trend is definitely past, in our opinion, and the tendency today is more toward economical semi-automatic standard or semi-standard machines that are available, and sufficiently flexible so that they can be used for other work in case of change of design, and yet of such a character as to produce economically.

The particular transmission case set-up illustrated is interesting in all events, but it appeals to me that some of the available multiple-spindle way drillers could be adopted so that probably less investment, obviously much less floor space, and probably less opportunity for trouble would result, and these machines, by changing the heads for other drill arrangements, can be made to function for other designs, or change of design from time to time. One of the fundamental difficulties that stands in the way of adopting this idea to any great extent, except in the field of drilling, tapping and reaming, is the fact that the surfaces worked upon must be produced in the early operations, and used in the later operations to locate by in the fixtures, and further, the surfaces produced in the beginning are worked upon by boring or drilling, etc., in later operations, and therefore must be exposed and held so that this work can be done.

In other instances, it is necessary to take a rough and finishing cut, and it is often advisable to take these finishing cuts after the intermediate operations will have been completed, so that all strains and warpage can be removed. In general, it is not uncommon to find intensive studies made of minor economies in machining, while on the other hand considerable sums of money are wasted every day in handling the parts in and out of the machines and departments, and it is also common to find marked inefficiency in the assembly work, due to the fact that the tool designing division are not especially interested in studying the needs and providing conveniences for the assembling work. In other words, there are many other means of wasting on the one hand, or saving on the other hand in shop management, that are much more responsive to intelligent study than the further refinement of the already refined direct machining operations. It seems to me that we would do better to attack these wastes.

From an Engineering Standpoint Nothing Stands in the Way

By E. J. Kearney

Kearney & Trecker Corporation

THE article prepared by Herbert E. Taylor of England, entitled "Production With Standardized Units," interests me very much. His contribution has added significance when taken in connection with the "Comeback of Britain," in Vol. 69, No. 23, by Dr. Julius Klein.

Mr. Taylor tells us indirectly that he is thinking along the only sure route to higher wages, higher standards of living and decreased unemployment. That route is increased per capita production. There are many expedients leading to that end. Mr. Taylor suggests an advanced method that has almost unlimited possibilities. As he states, the idea is not entirely new. It is used in a great many ways, to a greater or less degree, in a wide variety of fields.

On the Fox River, between Lake Winnebago and where that stream joins Green Bay, there is a factory building into which logs are carried by means of an endless chain. These logs are lifted from the river, dripping with water, into a machine which is one of a series, through which they pass without human aid, coming out as a broad sheet of fine paper, at a speed of several miles per hour.

A little to the east, on the shore of Lake Michigan, is a factory, making household utensils from aluminum, largely by press methods, some in several operations.

Conveyors move the part from one machine to another, and the finished product results without hands.

Farther south, on the western shores of the same lake, is another factory in which a machine automatically inspects strips of sheet steel, passing them on to a series of machines—marvelous and spectacular beyond belief—the end being a completely assembled and painted automobile frame, all done automatically.

Progress in Other Lines

Not so long ago, young men desiring to earn money for college expenses began the summer vacation in the harvest fields of Arkansas or Oklahoma and moved northward even into Canada as the season advanced. Today you'd find them tending concrete mixers, working in industrial plants, or some other employment, for the reason that the combined reaper and thresher is putting an end to the old-fashioned harvest. I recently heard of a spectacular stunt in which wheat was harvested, threshed and ground, after which it was sent by air mail to Boston, so that within forty-eight hours after it was decorating the landscape on the far side of the Missouri, Bostonians were varying their accustomed diet of pork, beans and pie with pancakes made from that same grain.

It is not inconceivable that a revolution may take place in the textile industries to such an extent that a suit of clothes may be completed from the raw wool without the aid of that ancient and honorable profession of the needle and shears.

It is a little difficult to imagine standard machine tools in anything like their present construction being used to build up a continuous system such as Mr. Taylor illustrates. It is easy, however, to see how machines of more limited ranges, and with some adaptation, might be made to finish automatically almost any piece. Possibly different sizes of similar pieces could be finished on the same machine by placing them in a fixture with standardized dimensions to facilitate its automatic transfer from one machine to another.

From an engineering standpoint, nothing stands in the way. Some will say that the failure of a cutting tool in the chain would put the whole system out of commission. Such chains must, of course, run at something less than their maximum capacity as individual machines, in order that cutting tools might need less frequent attention.

Conservatism the Greatest Drawback

Mr. Taylor speaks of conservatism as the greatest drawback. He probably intended, under this term, to classify many other things that would be obstacles to his plan. Some of these are: (1) small quantities; (2) unstable design; (3) high cost of equipment; (4) depreciation; (5) high interest rates; (6) high property tax; (7) cheap labor. Each individual piece would have to be considered by itself in the light of these and possibly other factors. It is difficult to pull out of the cheap labor quagmire. The cheaper the labor, the more handwork. The more handwork, the more costly the product. The more costly the product, the smaller the market. The smaller the market, the more unemployed. The more unemployed, the cheaper the labor, and so on around the circle.

Mr. Taylor's plan, and all that it implies, requires vision and courage on the part of the management like unto that of the management of a railroad that will now start to electrify its lines in anticipation of the volume necessary to make it profitable which it expects to have some years hence when the job is completed.

Taylor Plan Not Likely To Be Practical

By C. L. Campbell
President, Cadillac Machinery Company

IT SEEMS to us that the Morris people have picked a very poor piece to machine in this condition, without allowing it to cool. We are certain that a piece machined in the manner shown with the rapidity that is customary in this country would, by no means, pass inspection. Even the Chevrolet people find it policy to machine the ends of their case from the finished bore and to machine one end at a time to assure perfect alignment for gears and, of course, perfect gear centers.

There are so many cast iron pieces in a motor car that the period between operations becomes one of the essentials to a perfect piece. Frequently we find it necessary to create what is known as a bank, consisting of a given number of pieces between given operations to allow for the cooling of the piece.

Of course on the gear case as shown it would be possible to do a lot of the rough drilling and some tapping by a method similar to that shown, as long as none of the operations requires extreme accuracy.

We do not disagree with the fact that in many cases it would be policy to discard the frame of the motor entirely and place the motor as an integral part of the machine. In fact it has been contemplated a number of times but we think the author is quite visionary in imagining that a number of different manufacturers of machine tools will so standardize their machines as to be particularly adapted to this type of factory layout.

A Similar Case Years Back

Some years ago a visionary individual came to the office with the idea that if he could obtain enough machinery of enough different kinds and place the same on a continuous "Merry Go 'Round," or place the piece on a continuous "Merry Go 'Round," he would be machining such pieces as a cylinder block more cheaply than by any other method. This does not happen to be the case in practice in this territory because of the serious differences in the element and the job breakage or break down of tools on some of the operations which would necessitate the stopping of the entire unit, a thought that gives the production man cold chills.

When operations are somewhat split the treacherous ones are, if possible, given extra machine capacity to allow them to catch up for their down time. Naturally, some operations run almost constantly with a minimum of down time while others, because of their very nature, inherit a large percentage of down time. In the event that the operations were all hooked up the down time on one machine would, of necessity, hold up all operations.

We think the idea is undoubtedly a nice dream but doubt very much if it would be considered practical on the very few pieces.

High torsional resistance is important in thin walled tubular struts, it has been shown by tests made at the Bureau of Standards in connection with naval airplane members. The experiments showed that a great increase in compressive strength is gained by increasing the torsional rigidity. The results were based on tests of many tubular pieces of 1-in., 1½-in., and 2-in. diameters, principally duralumin and chrome-molybdenum steel.

Design of Shafts for Stiffness

Calculation of Forces

In most cases of shaft design only the deflection of the shaft need be considered, since a shaft that is stiff enough is usually strong enough. This simplifies the calculations, as the formulas for deflection are comparatively simple, the strength of the material does not enter into the problem, and the deflection is practically the same for all kinds and conditions of steel either heat-treated or untreated.

The deflection that may be allowed is dependent upon several factors such as the bearings, gears, and material of the shaft. Considering the bearings alone, a maximum deflection of 0.0015 in. for each inch of distance from the load to the center of bearing is considered good practice. As regards the gears, to wear well and run quietly, the deflection of the shaft at the gear should not exceed 0.005 in. for gears of one inch face, and proportionately less as the gears increase in width. The maximum deflection at the gear should not exceed 0.005 divided by F, where F equals a number equal to the width of the face of the gear in inches. As regards the material of the shaft, the above deflections are allowable for untreated shafts of machine steel with slow to medium speeds. For high speeds the above values should be halved, or the shafts may fail from fatigue. For shafts of alloy steel, which have been heat-treated to give high fatigue values, the allowable deflections may be much higher.

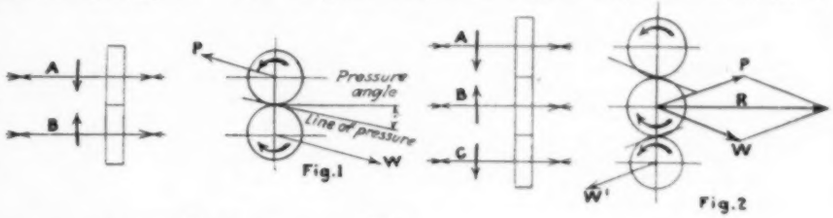
In some cases the torsional or angular deflection may be the deciding factor in calculating the shaft diameter. The allowable torsional deflection for shafts in machines, according to Leutwiler, is one degree in 20 diameters. This is probably good practice for untreated machine steel shafts. For heat-treated alloy steel shafts a torsional deflection of at least one degree in six to ten diameters may be allowable.

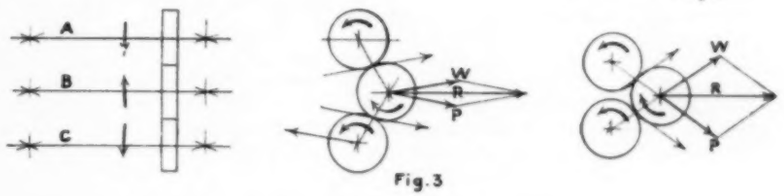
In order to calculate the deflection of a shaft with any degree of accuracy, the actual load should be determined. This may be the resultant of several loads which may be all in the same plane or different planes. In the case of a belt drive to a shaft with an overhung pulley, the load on the shaft is usually that caused by the total pull of the tight and loose sides of the belt. It is good practice to assume an effective belt pull of 50 lb. per inch of belt width for double belts, and a load on the shaft equal to four times the total effective belt pull. That is, the load W equals $B \times 50 \times 4$, equals $200\ B$, where B equals the belt width in inches. In extreme cases, where the pulley may be oily and the arc of contact very low, the load on the shaft may be 60 per cent greater.

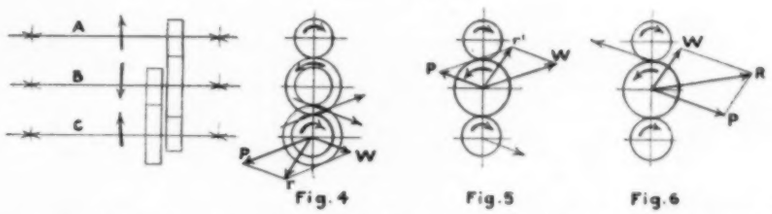
The following analysis covers common cases:

Two shafts with connecting gears, to find the direction of the forces. The forces transmitted by gear teeth are always along a line called the line of pressure. The pressure angle varies for different systems of gearing, 14½ and 20 deg. being those most commonly used. In Fig. 1, W represents the force acting on the driven shaft B, and P the force acting on the shaft A. The forces W and P are equal and opposite.

Three shafts in the same plane, with connecting gears, to find the direction and magnitude of the resultant force. In this case, as shown by Fig. 2, the force W is the same as in Fig. 1, and the force P is also a reaction force which is opposite and equal to the force W acting on the shaft C. The diagonal line R represents the direction and magnitude of the resultant force R acting on shaft B. For the 14½ deg. pressure angle R equals 1.93 W; and for the 20 deg. pressure angle R equals 1.88 W. The combination of gears shown in Fig. 2 should be avoided, if possible, as the load on the shaft B and the adjacent bearing becomes nearly double the load transmitted.







Three shafts in different planes, with connecting gears, to find the direction and magnitude of the resultant force acting on shaft B. It will be seen from Fig. 3 that the more the gears are wrapped around, the less the resultant R becomes. This is true even when the rotation of shafts is in the opposite direction to that shown. The calculation of forces is similar to that for the case of Fig. 2.

Three shafts in the same plane, with a group of connecting gears, to find the resultant force on shaft B. This case, as shown by Figs. 4, 5, and 6, is more difficult to analyze since the forces are not equal, and since there are three forces acting on shaft A. The method of procedure is as follows: Find the resultant force r on shaft C as indicated in Fig. 4. Then find the resultant r' of two of the forces acting on shaft B as indicated in Fig. 5. Next find the resultant R of r' and the third reaction force P as indicated in Fig. 6. This arrangement of gears is also to be avoided on account of the doubled loading of the shaft B and adjacent bearing.

Contributed by G. W. Drake, Advance Designer, The Warner & Swasey Company

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· TECHNICAL · ABSTRACTS ·

Aluminum Alloy Rivets in Aircraft Construction

The development of the use of aluminum alloys in aircraft construction has brought about a number of problems not altogether like those encountered in the use of other metals. In order to obviate any peculiar difficulties, such as specific corrosion due to electrolytic action, rivets should be of the same material as the parts to be joined together. In addition, they should be uniform in chemical composition. The limits to which this particular quality is desirable are not generally known, and until a great deal more is known regarding corrosion it is believed that a complete set of definite rules cannot be established. Pending the solution of the difficulties associated with corrosion, rivets should be uniform and as near the chemical composition of the parts to be joined as is practicable.

The identification of rivets, after they are manufactured and before they are driven, is extremely important, particularly to the user. There are in general use in the aircraft industry, rivets known as "aluminum rivets," which are relatively high in aluminum, and duralumin rivets, which conform to the ordinary duralumin composition. In no case is it desirable to substitute aluminum rivets for the duralumin rivets in aircraft. It is extremely desirable in structures made of relatively pure aluminum that aluminum rivets be used throughout.

The practice of identification in use abroad is simple and seems to present the greatest number of advantages. It consists of placing a dimple in the head of the duralumin rivet. This could as well be a raised tit, and where other kinds of rivets are adopted for use, the number of dimples or tits can be increased to suit; or other symbols can be placed on the head of the rivet. These markings will, of course, disappear, at least in part, when the rivets are driven, but the identification marks are primarily of interest prior to the rivets being driven and the marks recommended will therefore serve the purpose well.

The variation in the shape of the heads is practically infinite. There are, however, certain standard types which have been used in the steel industry for years, and which will undoubtedly carry over into the aluminum alloy field. These standard shapes should serve satisfactorily in the aircraft industry. They include: Round head, pan head, flat head and countersunk head. There are certain places in airplane construction where each of these types can be used to better advantage than the others.

The universal practice of spacing water-tight rivets at four diameters practically assures a good joint. It is believed that part of the difficulty in making gasoline-tight joints has been due to the lack of stiffness in the joint itself. The use of extruded shapes to give a seam the strength and stiffness desired is fundamentally sound, and water-tight spacing of the rivets should produce a gasoline-tight joint. Riveted gasoline tanks made of duralumin present a number of advantages over other constructions.

The use of round head, pan head and flat head rivets and points to match, should be limited to inside features in aircraft. These heads and points should not be considered satisfactory where they fall into the airstream of the plane, if the thickness of the parts being joined is sufficient to warrant the use of other rivets, or unless the conditions are special. Countersunk heads and points, and hammered points give a flush condition which is entirely satisfactory for the outside work. The countersinking allowed in a plate should, however, be limited to two-thirds the thickness of the plate.—*Airway Age*, Dec., 1928.

Progress in Materials Handling

Materials handling today may better be termed an industrial art than a science. Little or no research (except by a few isolated manufacturers) has been attempted, hardly any theoretical material has been published, and any uniform or comparable methods of keeping transportation costs still await the efforts of the engineer or plant executive.

The principal developments in conveyors have been along the trend toward "making on the move." Testing, weighing, assembling, and inspection are all carried out without the material's leaving the line; in many cases work-holding fixtures have been the means of accomplishing this end.

Progress in the development of electric trucks has been along the lines indicated in previous years—larger capacities, increasing lift range, and the development of special equipment to perform some special task. Die-handling trucks have been delivered to such firms as Fisher and Briggs with rated capacities of 12 and 14 tons, some of which are equipped with supplementary winches for moving the die on and off the high-lift platform.

Only a few developments in specific industries warrant particular attention, as there have been no outstanding changes in methods of either materials handling or other processes which would affect the former. Electroplating and heat-treating in the automotive industry have increased the use of conveyor apparatus, as accurate control of the process is accomplished by mechanical handling. Work-holding fixtures are found to be more prevalent. This in itself is a step in the direction of reduced costs.

The practice of placing authority for materials routing in the hands of one competent man has grown. This should be of increasing benefit to industry.

In one or two instances the handling method has influenced the manufacturing process. The ability to handle large dies has changed the methods in the automobile-body business, while the methods used in locomotive and car repair shops have been revised so that the engine or car is stripped outside the shop, the parts cleaned, and the erection shop devoted solely to the assembling process. — *Mechanical Engineering*, January.

Six Wheel Trucks in Germany

The outstanding features of the commercial car section of the Berlin automobile show were the large number of new six-wheeled chassis for trucks and buses and the almost total absence of 5-tonners. The reasons for these developments in Germany are to be sought in legal restrictions which limit the weight of completely loaded four-wheeled vehicles to 9 metric, or 9.92 English tons. With the adoption of starters and generators; of heavier, more powerful engines, and of other refinements, the net weight of trucks and buses has increased considerably, and the permissible pay load has decreased proportionately.

From a technical point of view the commercial vehicle section of the Berlin show was much more interesting this year than the passenger-car section; for whereas the latter reflected chiefly an endeavor to catch up with progress made elsewhere, there was evidence of much meritorious pioneer work in the commercial car section.

The chief developments disclosed were in connection with six-wheeled vehicles and forms of independent springing. While there is nothing basically new in six-wheeled vehicles, the first practical design of this kind having been evolved in this country 10 years ago, six-wheeled design is still in a state of development, and German engineers have worked out numerous new and interesting applications of the principle.

Independent springing of road wheels has had a good deal of attention in Europe in recent years, but chiefly on the part of independent inventors or little-known firms, and as applied to passenger cars, and this was undoubtedly the first time that several heavy vehicles embodying this feature were exhibited by well-established manufacturers. Three different types of construction were represented, characterized respectively by cross springs taking the place of supporting axles, axle tubes pivoted to a frame-mounted driving-gear housing, and stub axles in the form of cranks with bearings on the frame.—*Automotive Industries*, Dec. 15.

IDEAS · FROM · PRACTICAL · MEN

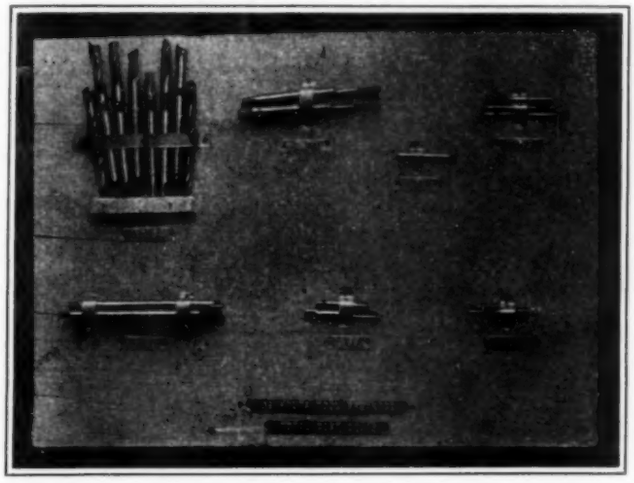
The department, "Ideas from Practical Men," is devoted to the exchange of information on methods useful to the machinery industries. Its scope includes all divisions of the metal-working industry, from drafting room to shipping platform. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for. The rates are from a minimum of five dollars upwards, depending upon their merit.

Displaying Broken Tools

By H. L. Bradford

The illustration shows an effective method of visualizing the number, nature, and cost of broken tools for the benefit of those who use them and those who are responsible for their use.

A board sufficiently large to display the tools without crowding is hung on the toolroom partition, or on



A display board for broken tools

the wall nearby. All of the broken tools turned into the toolcrib during a given time are fastened to its as shown. The cost of each class of tools, and the total cost, are shown at the bottom on zinc strips made up on the pattern number embossing machine.

It has been found more effective to use the number of hours, rather than the term, week, or month. Likewise to show broken drills worth $16.64 is more impressive than to show 8 drills worth $2.80 each.

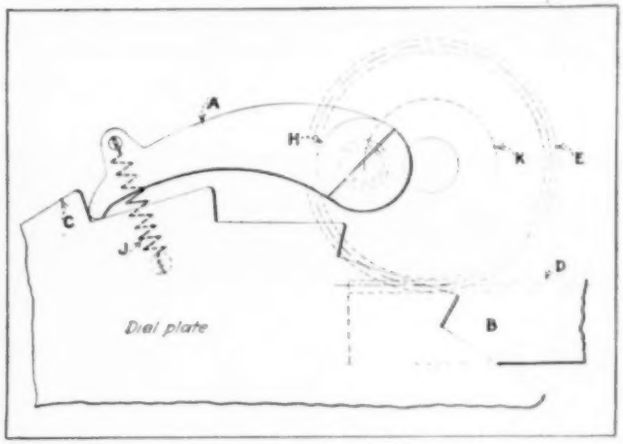
Two boards side by side illustrating tools broken during the two last periods, present an effective contrast. Photographs can be used to illustrate progress over long periods.

An Accelerating and Retarding Ratchet Pawl

By Joseph E. Fenno

The illustration shows the method by which the writer eliminated the jerking action of the ratchet dial plate of a special shell marking machine. The jerking, which occurred at the beginning and end of the dial movement, caused the unseating of some of the shells, resulting in considerable spoiled work.

Originally, the pawl *A* received a uniform reciprocating motion from the slide *B*, which also drove other members of the machine. As finally worked out, a rack *D*, which meshes with a spur gear *E*, is fastened to the slide *B*, which has sufficient stroke for the purpose. The



A pawl with circular motion

pawl *A* is pivoted on the gear *E* by the shouldered screw *H*, and the spring *J* insures its meshing properly with the ratchet teeth *C* of the dial plate.

The gradual starting and stopping of the dial plate is controlled by the path *K* that the pivot *H* must follow. The driving gear of the machine has been shifted 180 deg., so that the work cycle will remain the same.

A Method of Making Rubber Molds

By E. F. Fader

An innovation in the method of making rubber molds has been tried out in our plant with great success. The saving in cost over the usual method of manufacture is so great that it is worth using whenever possible, although its application is limited to shallow molds where the design is repeated at intervals.

The mold in question was to be used in the manufacture of edgings for mats. The design, known in the

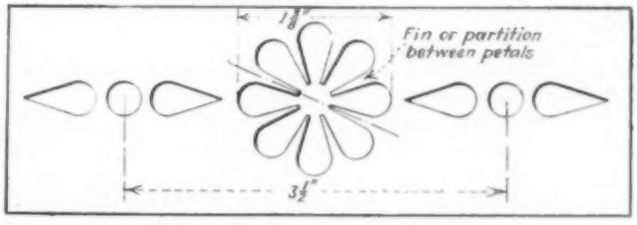


Fig. 1—The pattern or design

trade as "The Daisy Pattern" is shown in Fig. 1. This design was repeated 31 times in the length of the mold. The mold was 108 ½ in. long. The material was a mild, hot-rolled steel. The specifications required clean, sharp edges on the pattern with the surfaces finished dead smooth.

Our usual method of making such molds was by cutting or routing out the design with small end-mills revolving at high speed. Two or more cuts were taken to bring out the design, and one or more cuts to give it a smooth surface and to finish the edges. The final finish would be given with oil and abrasive, a hand operation.

Our experience with routing has been such that we avoid its use except where no other method of machining is practical. To rout out this design would be extremely expensive and the results might not be satisfactory.

When the job came up for planning, one of the staff suggested stamping or embossing the design and pointed out, since it was a repetitive design, only one pattern

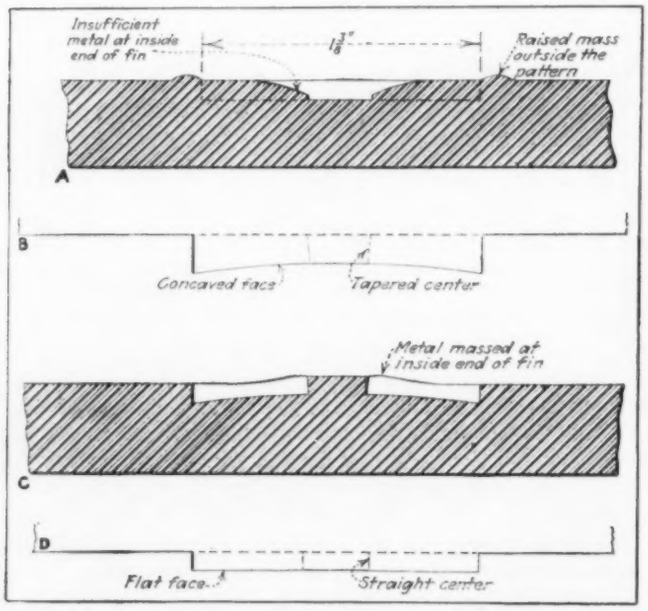


Fig. 2—A—Section through impression in mold. B—Contour of roughing hub. C—Section through first impression in mold. D—Contour of finishing hub

of hub would be needed. After some study it was decided to try stamping since the cost of the experiment would be small and the loss would be little if the process was not successful.

The hub was easily made. The design was cut on its face with the pattern raised to correspond with the depth wanted in the mold, plus a small clearance of about 0.010 in. After the mold plates had been surfaced, the hub was set up in a large, slow-motion press and tried out. The results were so disappointing that we were tempted to drop the experiment.

By reference to Fig. 1, it will be seen that the petals of the design converge to a common center of comparatively large and solid area. In being pressed into the metal this center carried down with it the inside ends of the fins or partitions between the petals, also a raised mass of metal was thrown up around the whole design. The section is shown *A*, Fig. 2. The clearance of 0.010 in. was eliminated in hope that the face of the hub block would force the metal raised around the design, back into it and so build up the drawn-down sections. This made only a very slight improvement, as the fins were still drawn down by the center of the hub.

The final solution of the difficulty was found in what amounted to a roughing hub having a relieved concave face that massed sufficient metal at the lean points to give a perfectly full impression when restamped with a finishing hub.

The roughing hub was a duplicate of the first hub made, except that it was cut to double the original depth and ground concave so that it struck the metal at the outer ends of the petals first. As the hub advanced into the metal, the natural flow of the surplus volume was from the outside ends to the inside or lean ends of the fins or partitions. The center of the hub did not reach the metal until a slight surplus had been deposited at that point. The concave was ground a little at a time and the hub was tried out between each grinding until the concave face carried just the right amount of metal to the center. It was found advisable to change the form of the center of the hub also. It was given a taper with the edge slightly rounded. This caused a counter-flow of metal that aided in building up the lean areas. A cross-section of the hub is shown at *B*, Fig. 2.

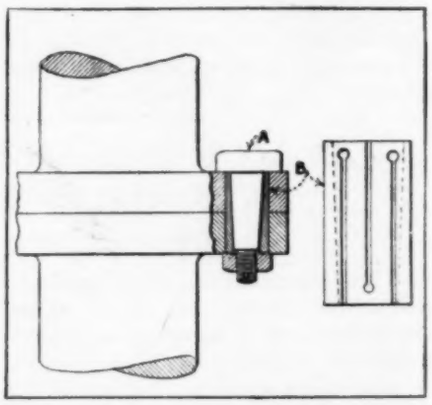
The roughing hub left the design in a semi-finished condition, as shown by the mold section *C* in Fig. 2. The impression was re-pressed with the finishing hub section (*D*, Fig. 2) with its flat face and square edges, and the design came out perfectly. No finishing was needed in the impression, but the whole top of the mold was given a light finishing cut to obliterate scratches and tool marks.

The mold was elongated $\frac{3}{16}$ in. in its length due to the redistribution of the metal, but as the length of 108½ in. was not a limit dimension no damage was done. The most pleasing part of the job was the cost, which was about one-third of the estimate for routing and hand finishing.

A Sleeve for a Taper Bolt

By H. C. Lane

A method used to assemble bolts in the flanges of a hydro-electric unit so that they can be removed easily is shown in the illustration. The runner of a water wheel, weighing at times 70 or more tons, hangs from the lower flange of the generator shaft without other support or bearing. Tapered bolts of a suitable diameter are used for bolting the two flanges together. These bolts can be applied readily by hammering the head and drawing up the nut with a long wrench. Disassembling, on the other hand, is extremely difficult as there is seldom a seat for a jack, or room to swing a sledge effectively. Recently, while inspecting a 7,000-hp. unit, the writer



A taper sleeve flange bolt

noticed the method shown, which is an adaptation of the split sleeve mandrel. In the present case the bolts *A* are approximately 4-in. diameter and the space between the flange and governing mechanism is limited. Using the split sleeve *B* allows the hole in both flanges to be reamed straight, and a greater angle of taper to be used on the bolts.

The sleeve holds the flanges in alignment and prevents any relative movement between the two. It also allows of a thin liner being placed between the sleeve and the inside of the reamed hole, should the bolt for any reason become loose.

By using this construction the rigidity of the connection is increased, and when necessary, a bolt is loosened with a few taps of a sledge.

Railway-Shop Storage Racks

By Frank C. Hudson

A method of storing boiler and fire-box plates, as well as structural steel for various purposes, is shown in Fig. 1. Steel horses, built of angles and either riveted or welded, separate the various kinds and sizes of plates. This arrangement makes it possible to see exactly what material is on hand and to remove any piece desired, without difficulty.

In the foreground are portable racks, or stalls, built up of old piping welded in the form shown. These racks are made in units of two openings each, so as to be moved easily and fitted into comparatively small spaces. They are used for storing small, left-over pieces of plate. Such racks keep the material off of the floor, and make

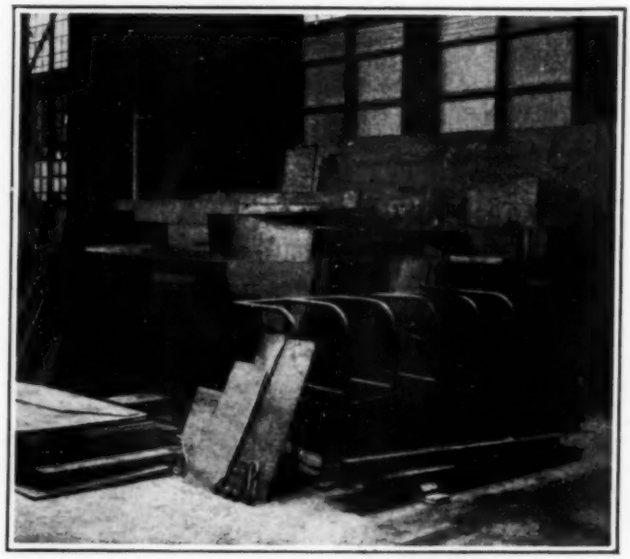


Fig. 1—Rack used for storing steel plates

it easy to find a suitable piece when needed for any special purpose.

Storing and keeping track of the numerous pipes that belong to a modern locomotive when it has been dismantled for general overhauling, is frequently something of a problem. The racks illustrated in Fig. 2 are a considerably larger edition of the small racks previously described and, like them, are also built up of tubing welded at the various joints. There are twelve stalls, each being designated by a number that corresponds with that of the locomotive from which the group of pipes has been removed. This makes it easy to keep together all the piping from any particular locomotive, and frequently saves considerable delay when the locomotive is being erected again for service. Both of these storage methods are from the shops of the Canadian National Railway, Moncton, N. B., Canada.

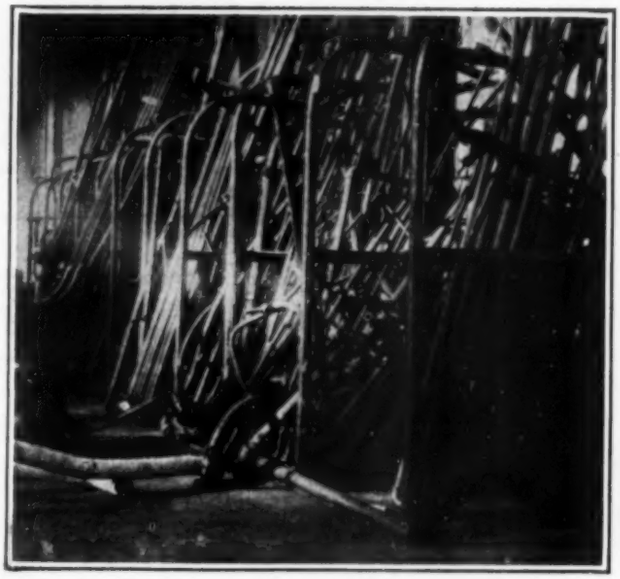
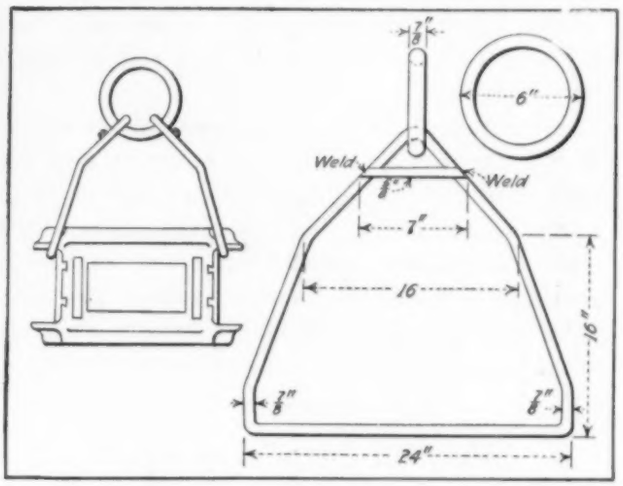


Fig. 2—Storage bins built of welded steel piping

Hooks for Handling Driving Boxes

By J. H. Hahn

The illustration shows a pair of very good hooks for handling driving boxes on and off of boring mills, planers, slotters, etc., during the various processes and operations of machining and fitting up. The hooks are made of cold- or hot-rolled steel $\frac{7}{8}$ in. in diameter, and are



Details of hooks for handling driving boxes

formed to the shape shown in the sketch. The dimensions can be varied to suit boxes of different sizes.

The two parts, or sections, are held together by the ring shown, and a piece of $\frac{5}{8}$-in. round material is welded near the tops of the two sections to prevent the ring from slipping down. Hooks of this type are a good addition to the safety devices of the shop, and considerable time will be saved by their use.

American Machinist

Editors: KENNETH H. CONDIT AND FRED H. COLVIN

Established 1877

House Bill 7208 Is Dead

DIFFERENCES of opinion as to the meaning of legal phrases are the cause of much confusion in many walks of life. A case in point was the Tillson Bill H.R. 7208, considered harmless by its sponsor but feared by some manufacturers as giving what might be called "police" power to the Bureau of Standards—in other words lending it an administrative character that differs materially from its original functions. The effect of such power on manufacturers would, of course, depend largely on the leanings and the personality of the head of the Bureau. And while those who know Dr. Burgess have no fears as to his attitude, manufacturers do not favor legislation that will make interference possible at some later date.

Although Representative Tillson feels that the bill sponsored by him had no relation to the compulsory use of the metric system, he has assured his friends that the bill in question is dead and that he will not be a party to any legislation that could possibly be construed as aiding the compulsory adoption of another system of weights and measures. This attitude on the part of Representative Tillson is very gratifying and exactly what was expected by those who know him and his legislative work in the past.

Advocates of the compulsory use of the metric system are always on the alert, however, and new bills, with various apparent objects, are likely to come to light at any time. Recent letters to the *Ameircan Machinist* from many manufacturers in varied lines reveal the unanimous belief that they have nothing to gain and much to lose by a change in the present system of measurements.

Mr. Ford Experiments Again

MR. FORD'S announcement that he is going to employ thirty thousand additional workers, and operate his machinery six days a week while his men work five, does not seem to have stirred up as much excitement as his earlier experiments with the relatively high minimum wage. The first experiment met with a perfect storm of protest but today there are men fair enough to admit that the setting of the five-dollar-a-day minimum wage was one of the big factors in the conversion of the employer to the belief that it pays to increase the purchasing power of labor. Perhaps the change of opinion on Mr. Ford's first experiment has sounded a warning to those who might otherwise be hasty in condemning the latest move.

On the face of it, the new program appears to be confronted with difficulties. The job of keeping track of men some of whom are off on Monday, others on Wednesday, and so on, would be a staggering one for the average employer. But this task is probably not much harder than the one of getting so many men to and from the plant.

It is obviously sound economically to run the production machinery as many days per week as possible. Machines do not get tired and slack off in their output. But whether it is wise to give the average automobile plant worker two days off each week is not quite so certain, although it may be entirely satisfactory so long as they are not all at liberty at the same time.

This much must be admitted for Mr. Ford's plan: it provides work for thirty thousand more men, and that is eminently worth while, provided they can be kept profitably employed. Perhaps, after all, Mr. Ford has found here the answer to the Saturday half-day problem. If he is successful it seems likely that another step has been taken toward the five-day week for the worker.

Winthrop Ingersoll

THE machine tool industry has lost a man who was responsible for greater changes than most of the present generation probably realize. Quiet in speech and demeanor, he never blew his own horn loudly enough to attract attention to himself. But it was his foresight and persistence in the face of the great inertia of custom, and of much opposition from those who demanded to be shown, that made the planer-type milling machine a factor both in modern mass production and in railroad shop work. And this not only meant designing and building the machine, but providing suitable cutters, devising methods and educating men to their use. This type of machine is now so common that younger men may be pardoned for thinking it always existed. But the old-timers will remember when it was a novelty, and recall the efforts that were necessary to put it across. The passing of Winthrop Ingersoll is not only a loss to the industry, but to his many warm friends.

Shields Plain and Universal Milling Machines

FOUR sizes of plain and universal milling machines are being manufactured by the Shields Machine Tool Company, Inc., 407 West St., New York, N. Y. The plain milling machine is built primarily for production work, and at the same time has sufficient flexibility to meet the requirements of the toolroom. It will handle all milling work that does not require the table to swivel. It is provided with the standardized spindle nose, power feeds in all directions, spindle reverse, automatic cutter coolant system, plain vise and other accessories. The spindle is carried in a phosphor-bronze bearing at the front end and a ball bearing at the rear.

One of the features of the line is simplicity in design. For instance, there are no tumbler boxes nor feed boxes, no universal joints nor shafts, no oil cups nor oil holes, and no coolant hose. Clutch, spindle and friction feed drives are adjusted from the outside. Among the improved features is the use of chrome-nickel semi-steel castings, with box-type construction of the column. Each shaft is mounted on ball bearings at both ends, seated directly in the casting. All shafts are of alloy steel, and all gears are carburized and hardened. A patented feature is the fact that all the feed mechanisms are entirely inclosed in the knee, control being from the front. The column knee and saddle mechanisms run in oil baths, and the gear shifts are made by selective sliding gears.

As shown by Fig. 1, a square overarm is used. The saddle pan, integral with the saddle, catches the coolant and drains it back to the reservoir. Constant-speed pulley drive is used. A coolant pump is built into the machine and operates only while the spindle is running.

Following are some of the other features: Rectangular ways on all sizes of machines on the column-to-knee and knee-to-saddle; flywheel on pulley, adjustment of the friction feed drive, clutch and spindle from the outside; spindle and feed reverse; power feed in all directions on all sides of machine; eight speeds and eight feeds forward and reverse in geometrical progression; friction feed drive, and means for starting and stopping the machine from both sides. The universal miller, shown in Fig. 1, is exactly the same as the plain miller with the exception of the saddle, the universal saddle being made in two pieces to enable the table to be swiveled horizontally. In Fig. 2 is shown a rear view of one of the plain milling machines indicating that there are no obstructing or revolving parts outside.

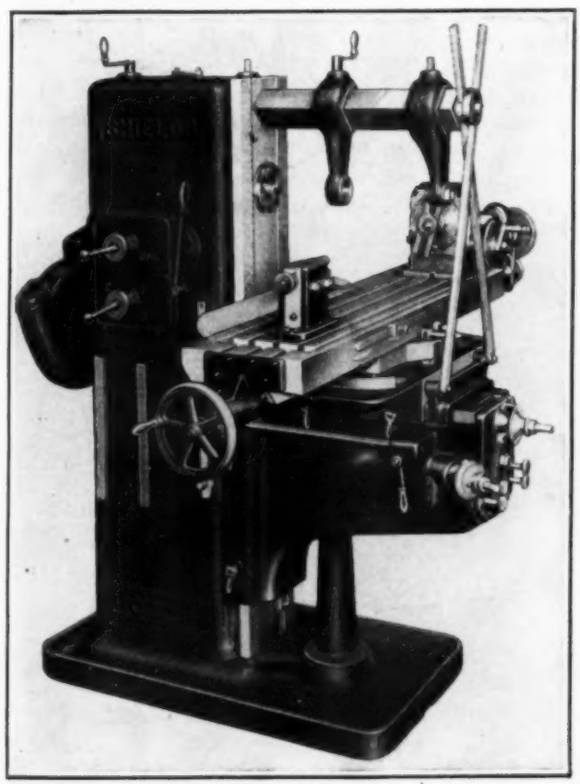


Fig. 1—Shields Universal Milling Machine

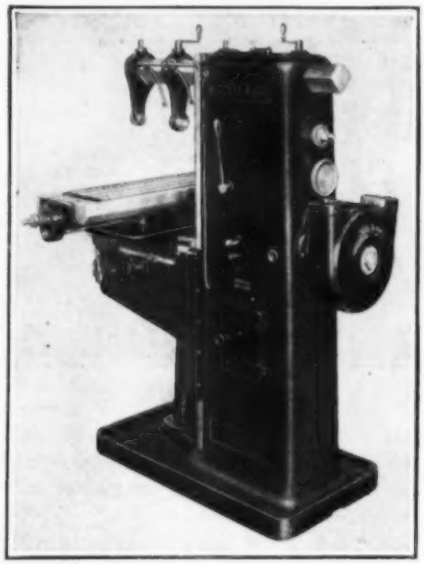


Fig. 2—Rear view showing the absence of rotating or obstructing parts

As mentioned previously, four sizes of these milling machines are manufactured. The second and third sizes are available in both standard and heavy models, whereas the first and last are built in the heavy and standard styles respectively. The main differences between the standard and heavy models are in the weight and the power, the dimensions being much the same.

For the No. 1 heavy type, the important specifications are as follows: Range, longitudinal, 22 in., transverse, 8 in., vertical, 18 in.; table surface 11x40 in.; capacity, column face to braces, 23 in.; spindle to underarm, 5¼ in.; universal dividing head, swing 10 in., length between centers, 25 in.; floor space 5 ft. 4 in. by 7 ft. The specifications for the No. 4 standard model are: Range, longitudinal, 42 in., transverse, 14 in., vertical, 19 in.; table surface 15x69 in.; capacity, column to braces, 33½ in., spindle to underarm, 7 in.; universal dividing head, swing 14 in., between centers, 49 in., floor space 7 ft. 7 in. by 10 ft. 4 in. The power required varies from 2 to 7½ hp., whereas the weights vary from 3,100 to 6,800 pounds.

Ouellet Optical Device

For the use in the immediate, personal attention of minor eye injuries when the prompt removal of a particle may prevent discomfort or more

Ouellet Optical Device shown in use

serious irritation of the eye, the optical device shown was developed by A. F. Ouellet, Room 507, 1140 Broadway, New York, N. Y. It is a small, five-power magnifying mirror, 1 in. in diam., with a wire holder for attaching to the finger. The mirror is backed by a German silver case, and the holding wire is made of the same material.

In use the mirror is clamped to the little finger of the left hand as shown in the illustration, the thumb and forefinger being used to keep the eyelids back, while the particle is removed with the other hand by means of a folded paper cut to a point. The action is observed with the eye that is being treated, and besides magnifying the eye, the mirror also enables light to be reflected where needed. The device, which is supplied in a chamois case, has been approved by medical authorities. It is obvious, of course, that if the particle cannot be wiped out, nothing further should be attempted until competent medical attention is secured.

"Mansaver" Automatic Tapping Machine

PIECES as large as 12x8x6 in. can be tapped automatically at a rate varying from 20 to 80 pieces per minute in the "Mansaver" automatic tapping machine, according to the manufacturer, the J-B Engineering Sales Company, New Haven, Conn. In addition to tapping, the machine can be arranged to insert screws or rivets, upset screw threads, spin rivets after insertion, do light forming after tapping, countersinking and light drilling.

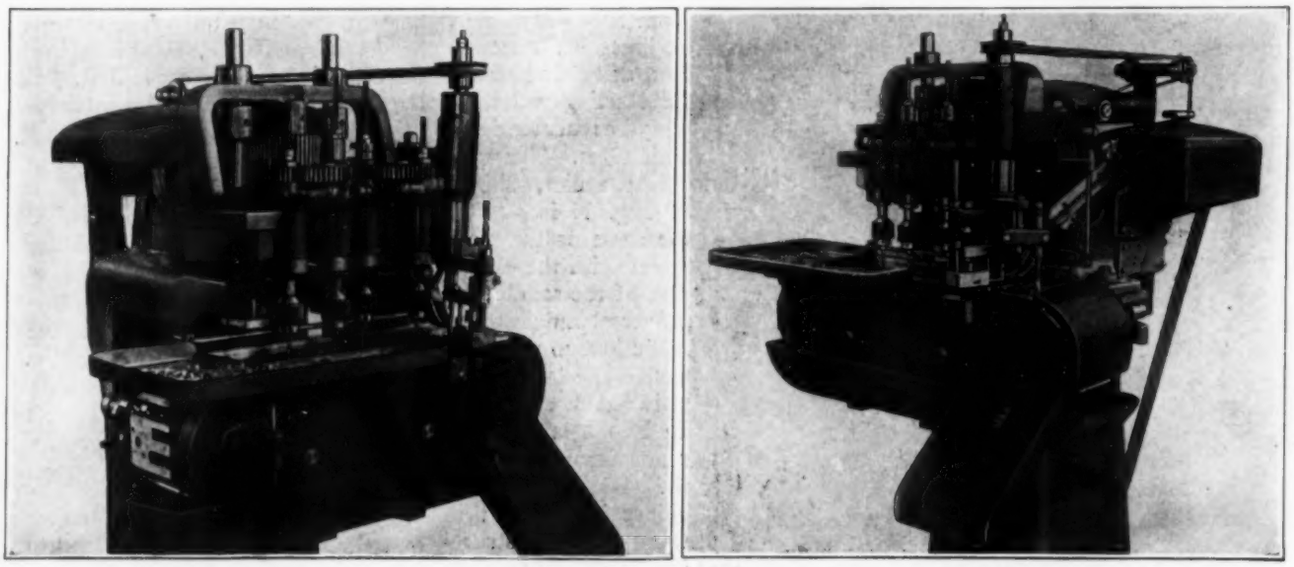
The essential elements of the machine are the adjustable tapping heads and feeding mechanism. The maximum number of holes tapped in a single-head machine is eight, but due to the method of feeding, this number may be increased by means of a double- or triple-head machine. Holes can be tapped as closely on the Mansaver automatic tapper as can be tapped on a single-spindle machine.

The tapping heads are driven by a reciprocating rack-and-pinion drive and intermediate steel spur gears. All gears have extra wide face to give long life and uninterrupted service. The spindles are positively driven, but are so arranged, with a compensating head, that the tap follows its own lead, permitting the use of different size taps in the same machine. Taps are held by standard chucks. All spindle bearings, as well as most other machine bearings, are ball bearings to insure accuracy.

The main drive consists of a hardened and ground nickel-steel worm mounted on ball bearings, meshing with bronze gears and driven by either belt or electric motor. The motor is mounted on a tilting plate to permit tightening and adjustment of belt.

Automatic feeding of parts to be tapped is arranged for. Actual feeding is done by conveyor, drum, or push mechanism especially designed for the piece to be handled, and the completed part is ejected automatically after counting, if a count is desired.

A screw driver head as well as special upsetting heads can be supplied. The screw driver head locates the slot in the screw opposite the screw driver before feeding. This eliminates scratching the screw head and burring the screw slot. Screws can be driven either part way or all the way into a hole. Screws can be staked or spun after insertion. A fixed hopper is used for feeding screws automatically. Screws are delivered to the feeding chute in a vertical position by a lifting mechanism in the hopper which lifts only a few screws. Screws are fed to the work one at a time by a special feed-



Two views of the Mansaver Automatic Tapping Machine using a conveyor type of feed

ing mechanism which prevents jamming. The screw to be inserted is held by mechanical fingers which place it in position.

When by reason of the high speed and continuous action of the taps coolant is required, cutting compounds are supplied to the taps by a self-contained oil pump. The oil reservoir is placed inside the machine bed. The supporting bed and frame are one piece to insure rigidity, and the baseplate is supplied with an oil drip lip to insure clean floors.

Ryerson Small Combination Shear, Punch and Coper

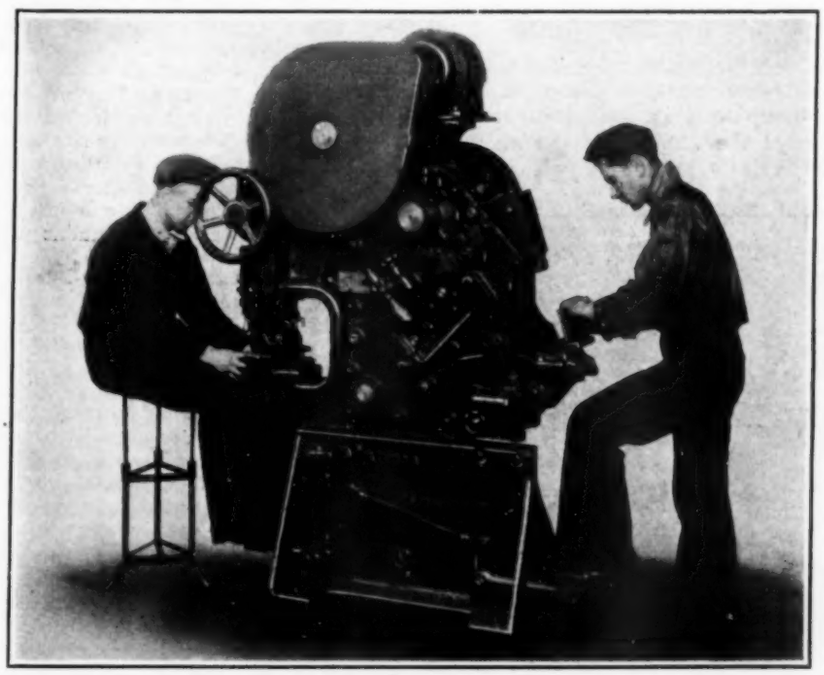
A MACHINE for the shop handling a varied class of work on the smaller steel sections is now being marketed by Joseph T. Ryerson & Son, Inc., Chicago, Ill. The machine performs punching, plate and bar shearing, angle and T cutting, angle and T mitering, coping and notching.

The punch has a deep throat, and is capable of punching most varieties of structural shapes having webs or flanges from $\frac{11}{16}$ to $\frac{1}{2}$ in. in thickness. The operation of the punch is not interfered with in any manner by the other units built into the machine. The shearing end of the machine is constructed so that a single slide may be used for shearing angles, bar cutting, plate shearing, and coping. The angle shear attachment performs both inside and outside miter cutting, as well as straight shearing. The blades in the shear unit are made in sections.

The bar-cutting blades are located directly below the angle shear blades. These cutters handle both round and square sections, and consist of two blades only. Directly below the bar cutter are located the plate-shearing blades, which will handle plates of any width or length, and up to $\frac{3}{8}$ in. in thickness.

The coping device is built at the shear end of the machine, and is extended out from the frame. It is located at a convenient height for operation, and is built-in so that time will not be lost in making special set-ups for this class of work. The coping device is regularly furnished in the V-notch type, but the square-notching type can be provided. The time required to change from one to the other is nominal.

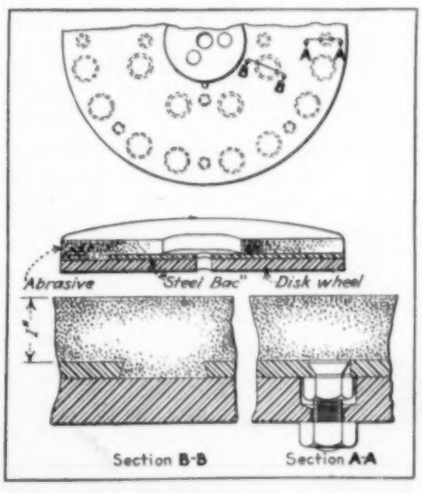
The drive is taken through all-steel gears to alloy-steel eccentric shafts. The clutches are of the two-jaw type, giving the operator a chance to engage the clutch every half revolution of the clutch gear, which is a time-saving feature. The main frame of the machine consists of a one-piece alloy-steel casting extending from the floor up to the motor shelf. The bearings throughout have bronze bushings, and care has been taken to provide proper lubrication. The working heights of the various attachments have been made such that the base of the machine can be placed directly on the floor. This eliminates the necessity of building up a concrete pier in order to bring the machine up to a proper working height, and makes the machine more readily portable.



Ryerson Small Combination Punch, Shear and Coper

Besly "Titan Steel-Bac" Bakelite Abrasive Disk

Charles H. Besly and Company, 118 to 124 North Clinton St., Chicago, Ill., have announced a line of Bakelite abrasive disks for both wet and dry grinding. These "Steel-Bac" abrasive disks consist of a comparatively thin steel plate on which the abrasive is built. The Steel-Bac is bolted to the steel disk wheel of the grinder, and, when the abrasive is worn off, the thin steel plate is returned to the manufacturer, the abrasive is rebuilt, and the unit returned to the customer.



Sectional views of the Besly "Steel-Bac" Bakelite Abrasive Disk

The abrasive is held to the steel plate by means of a series of undercut holes drilled in the steel plate, and by a special Bakelite cement. It

is claimed that this method makes it impossible for the abrasive to come away from the steel plate, and that it safeguards the operator.

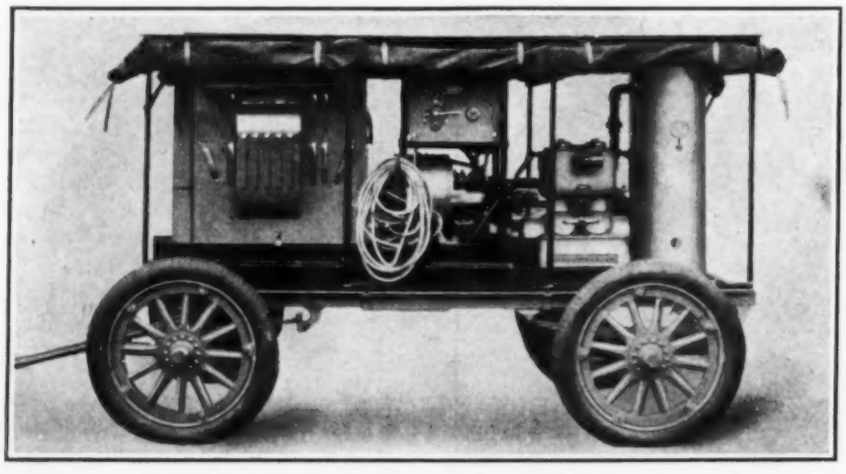
A series of studs are provided to secure the Steel-Bac to the disk wheel of the grinder. The disk wheel must be drilled and counterbored to receive these studs. A key in the taper head of each bolt is fitted into the corresponding keyway in the Steel-Bac thus preventing the stud from turning. This construction is shown by the illustration.

The abrasive member is made of artificial abrasive grains bonded with Bakelite, the mix being baked on the Steel-Bac. The manufacturer states that the abrasive can be worn down almost to the steel plate. A wide grinding zone, which is desirable in most disk grinding, is obtainable, and it is stated that the time required to attach the Steel-Bac to the disk wheel of the grinder is much less than that required to set a ring wheel in a chuck. Five sizes are provided. They are 18, 20, 23, 26 and 30 in. in diameter.

Wilson Gas-Engine-Driven Welder

This special gasoline-engine-driven welder, equipped with Ingersoll-Rand air compressor, has been developed by the Wilson Welder & Metals Company, Inc., Hoboken, N. J. As will be noted in the accompanying illustration, the motor and welding unit are placed in the front part of the channel bed, the air compressor and receiver being mounted at the rear. The unit is supplied with fabric curtains, which can be rolled up during use and fastened down securely to prevent damage to the machine during inclement weather. The whole unit is suspended on springs, and pneumatic tires are provided on the wheels.

The rubber-tired wheels, together with the special handle, permit pulling the machine behind a truck at a rapid rate over ordinary roads. The combination of the welding apparatus and air compressor make this unit of particular use when riveting, chipping and grinding are necessary in addition to welding.



Wilson Gas-Engine-Driven Welder with Ingersoll-Rand Air Compressor

"Niedhammer" Screw Driving and Nut Setting Chuck

The principal features of the "Niedhammer" nut setting and screw driving chuck are that the amount of friction between the driving and driven members can be closely adjusted to suit each particular job and that as a screw or nut becomes tightened a hammering effect is imparted to drive it home securely without jamming. This tool can be used in either drilling machine, electric or air drill, or on a flexible shaft. The Chas. L. Jarvis Co., Gildersleeve, Conn., makes the device in four sizes.

The chuck can be driven from a Morse taper, a taper nose such as is used on some portable tools, or can be fitted over the spindle if wanted. The No. 1 size has capacity for driving screws up to $\frac{1}{4}$ in. and capacity for nut setting up to $\frac{7}{16}$ in.; the No $1\frac{1}{2}$ size, up to $\frac{3}{8}$ in. and $\frac{1}{4}$ in., respectively; the No. 2 for $\frac{5}{8}$ and $\frac{1}{2}$ in., respectively, and No. $2\frac{1}{2}$ size, up to 1 in. and $\frac{3}{4}$ in. respectively. Three balls are used in a special friction device which allows adjustment by tightening down the top collar. As a screw or nut is tightened into place and the power required increases, the pressure of the spring is overcome to such an extent that the balls withdraw from their pockets and move in a path around the flange of the nose piece. The balls tend to reseat themselves in the pockets as they pass over, and this action results in a rapid succession of light hammer blows which drive the nut or screw securely into place.

"Niedhammer" Screw Driving and Nut Setting Chuck

Trade Publications

TRANSFORMERS, DISTRIBUTION. The Wagner Electric Corporation, St. Louis, Missouri, has published Bulletin No. 160 on the Types HE, HP, HS, and SP transformers, which are available in single-phase and three-phase pole-types and subway-types, in ratings up to and including 500 kva. One-half of the catalog is devoted to a detailed description of the design and construction of the Wagner distribution transformers, and the remainder is devoted to ratings and shipping weights. The catalog is well illustrated, and many tables and specifications are given. It contains 52 11x8½-in. pages.

OBSOLETE AND INACTIVE PATTERNS. The Policyholders' Service Bureau, Metropolitan Life Insurance Co., New York, N. Y., has published a pamphlet entitled, "Obsolete and Inactive Patterns." The means are cited by which 80 foundries and foundrymen's associations have sought to answer the problems of when little-used foundry patterns pass from the inactive to the obsolete stage and the different methods for scrapping obsolete patterns in such a way that replacement costs are below what storage expense would be if all patterns were retained. Of particular interest is the card index system for keeping a record of all patterns.

News of the Week

More Models by Fewer Makers at the 29th Annual Automobile Show

TWO features marked the 29th annual automobile show in New York, Jan. 5 to 12, at the Grand Central Palace, New York City, the display of a larger number of models by fewer makers and the introduction of foreign cars into the show. Consolidations of companies during the year and the switching of one of the old companies from the automobile to the airplane field, account for the lessening in the number of builders, while the additional models in several instances seems to be an attempt to give dealers a more complete line with which to meet both the size and the price demands of their customers. An example of this is found in the Franklin company that for years built but one size of car but which now has three wheelbases and prices that correspond. The general price trend is also downward, although there are few reductions which could be called sweeping even by advertising agents.

Colors Still Predominate

Colors still predominate in car finishes, but in most cases they are less startling than last year. In fact, the cars that stand out conspicuously are those in which black predominates. Black bodies and light fenders also make a striking contrast in a few cases. Chromium plating is used by an increasing number for securing non-tarnishing finishes for radiators, lamps and other similar parts. Bumpers are either regular equipment or frames are designed to receive them without drilling, it being recognized that they are as essential as fenders in these days of crowded roads and streets.

Fenders, especially front fenders, are being made with shorter aprons so as to afford access to the brake adjustments on the front wheels. There are also more fenders with wells for carrying spare times, especially in bodies with rear storage space, so as to make it easier to handle luggage. In a few cases there is more room between the rear fenders and the tires.

Four-cylinder cars are becoming noticeably less while the number of 8-in-line cars is larger than ever before. The V-8 is just about holding its own, one former builder having abandoned it for the line-8, but there are rumors of another V in the medium price class, to take its place. There are at present five models of V-8s, two being built by one maker with a very small production. Over thirty cars however now have 8-in-line engines, the number of 6s being given as over fifty. But three 4-cylinder cars are shown, Ford not exhibiting, as usual.

Engine power has been increased in nearly all cases, high compression now being the rule, and in most cases engine speed has been stepped up to some extent. One of the small 6s now peaks at 3,600 r.p.m. with 70 miles an hour as its advertised speed. Horsepowers up to 125 and speed possibilities up to 100 miles per hour are advertised.

Rubber Engine Mounts

Engine mounting in rubber is now almost universal, the method and the amount of rubber used varying widely with the class of car and the ideas of the designer. Rubber spring mounting, on the other hand, shows no appreciable increase. Fuel pumps are largely replacing the vacuum tank on both high- and low-priced cars. Some of the special carburetors used have intricate and fanciful connections that seem complicated to the user.

Although the great majority of the cars exhibited retain the standard three-speed transmission there seems to be a trend toward four speeds, this tendency extending from the $1,000 class clear to the top. Non-clashing transmissions are also being used a little more widely but not to any great extent as yet. A new device appearing on two cars is known as the "No-back," which prevents the car rolling backwards, even without the brake set, unless the transmission lever is in reverse. This is to prevent accidents from cars backing down hill and should make it easier to start up a stiff hill.

Four-wheel brakes are now as universal as balloon tires, the great majority being mechanically operated. Some retain the hydraulic brake but its use does not seem to be increasing. More of the brakes utilize the self-braking or "servo" principle and all have given much attention to greater ease and accuracy in adjustment. There seems to be an unmistakable tendency to place the parking brake lever on the left, with only the shift lever in the center. Hydraulic shock absorbers on the other hand, are growing in popularity, nearly all cars being equipped with some form of hydraulic device. For the moment the one-way principle predominates but the two-way devices seem to be increasing in number.

Frames are almost universally deeper than before, due to the trend toward longer wheel bases once more. In most cases the whole channel is made deeper, but one maker secures additional stiffness by riveting an additional channel below the main channel of the frame, for a portion of its length. Cross bracing is more frequent and more substantial, and takes many forms. The treads are also widening from the old standard of 56 in. to 58 and 59 in. in some cases. This makes for wider seats without overhang. One maker has a slightly wider tread in the rear than in front. Fabric universal joints are still used but not to the same extent as a few years ago.

Chassis lubrication continues to secure more attention, the piping of lubricant to all bearings being more in evidence than ever before, regardless of the price of the car. On the other hand the pressure grease gun is still much in evidence, and has replaced a wick oiler that was for years a feature of one well-known car.

Steering wheels and instrument boards change from year to year. First everything is put on the wheel and then all controls go back to the instrument board. This year the board has it in nearly all cases. In one or two cases however the so-called finger-tip control makes what is usually the horn button handle the starter, all the lighting and still retain its horn blowing mission. Steering wheel rims are again smaller, and are of composition built up on a steel core. Seats are largely adjustable and road vision seems to be receiving a little more attention. Wheel hubs are larger, many being covered with a large metal cap that simply slips over the hub of the wheel and can be readily forced off if it becomes necessary.

Foreign Cars Exhibited

Of the foreign cars, perhaps the Austin-7, which is the horsepower instead of the number of cylinders, attracted most attention. Smaller than any car we have ever built, and yet capable of carrying four people, even if not comfortably, it contrasted strangely with the huge Renault and Mercedes-Benz close by. Without questioning its ability to do all that is claimed for it, it is difficult to see how such a car can ever find a market in this country, almost regardless of the price at which it might be sold. Of the other foreign cars, the Daimler and the Vauxhall, comment is unnecessary. They are splendid examples of cars in their class, but they are not for the great bulk of buyers in this market.

Among those exhibiting in the accessory and equipment sections were: Aluminum Company of America, Pittsburgh, Pa.; Carborundum Co., Perth Amboy, N. J.; Gits Bros. Manufactur-

ing Co., Chicago, Ill.; Millers Falls Co., Millers Falls, Mass.; Westinghouse Electric & Manufacturing Co., E. Pittsburgh, Pa.; Wyman-Gordon Co., Worcester, Mass.; Black & Decker Manufacturing Co., Towson, Md.; Champion Pneumatic Machinery Co., Chicago, Ill.; Curtis Pneumatic Machinery Co., St. Louis, Mo.; General Electric Co., Schenectady, N. Y.; Hutto Engineering Co., Detroit, Mich.; Snap-On Wrench Co., Chicago, Ill.; South Bend Lathe Works, South Bend, Ind.; L. S. Starrett Co., Athol, Mass.; Stevens Walden-Worcester, Inc., Worcester, Mass.; Van Dorn Electric Tool Co., Cleveland, Ohio; Van Norman Machine Tool Co., Springfield, Mass.

Automotive Builders Look to Foreign Markets

While there is not much of a sign of saturation in the domestic market for automobiles, after a record year, it is interesting to note that the prospects of increased foreign trade are better than ever, according to *The American Automobile*. It is expected that the three largest markets for cars this year will be Australia, Argentina and Germany. The Orient has but few "sore spots," and even China is considered a satisfactory market. India also is becoming a source of orders for American cars, although there are many difficulties to be faced.

The so-called automobile penetration of Europe has continued in the past year, and expanding markets lead to the conclusion that more business can be expected there in 1929. South Africa kept right ahead as a market despite predictions that it would slump off in 1928, but then such predictions are made every year. About 40,000 American cars were sold in Germany in 1928, and it is anticipated that this number will be increased by 50 per cent this year.

Stimulation of South American markets will undoubtable follow the attention focused upon that region by reason of President-Elect Hoover's recent visits there, together with the development of highways now under way.

Added Testimony

In predicting an output of 5,000,000 cars in 1929, John Willys, president of the Willys-Overland Co., stresses foreign markets, in particular South America and Australia, where no automotive manufacturing is being carried on at present. He also thinks that we can amply compete in European markets due to our superior mass-production methods.

The National Bank of Commerce of New York also believes that the potential demand for cars abroad is of real importance. The bank calls attention to the fact that four-fifths of all cars are in the United States, indicating that other sections of the world are capable of a more gradual, but substantial, development. In its publication *Commerce Monthly*, another angle is presented also:

"The competition from American cars, even in the most highly protected European markets, is exerting a profound influence not only on manufacturing methods and design, but on the organization of the European industry as well, and on the basic philosophy underlying it. A vast number of manufacturers with a highly individualized but extremely small output, catering to a luxury trade, has been characteristic of the European industry. But already the bulk of production is concentrated within comparatively few companies. In Britain five concerns account for half of the domestic output. Three companies turn out nearly four-fifths of the French cars. In Germany one company is responsible for half the output, and in Italy one concern makes 80 per cent of the total. Western Europe is naturally by far the greatest market for motor vehicles outside of America."

Increasing Importance of Export Trade

Another example of the increasing importance of export trade is given in the fact that during the first eleven months of 1928, exports of agricultural machinery from the United States reached a value of $107,000,000, a figure never before reached in any calendar year, according to the Department of Commerce. It is apparent that the full year's figure will show an unprecedented increase for these products. Shipments during November were more than $1,000,000 greater than those of the preceding month, and $2,000,000 above the exports of November, 1927. Incidentally, October shipments of tractors were unusually high, comprising more than half the total implement exports for that month.

Domestic sales of 72 manufacturers in November were 1.6 per cent above those of the same month a year ago, and total production during the month, based on average employment, was 24.2 per cent higher. Implement manufacturers were one of the leading buyers of production equipment in the Chicago territory for the year.

Machinery Builder Busy with Foreign Orders

Enough large orders for glass machinery are coming in from France and England to make export shipments practically equal to domestic shipments, according to E. F. Dice, manager of the Lynch Glass Machine Co., Anderson, Ind. The plant is working almost to capacity, and officials say that it is difficult to enlarge operation because of a scarcity of general machinists.

Another plant in Anderson that is rushed is the Nicholson File plant, which was operated through the holidays, except for Christmas Day, for the first time in years. Officials of the company state that sufficient business is on hand to keep the factory employed at capacity for some time. A total of 5,000 dozen files are being finished each day.

Conference on Materials for Airplanes

Materials for use in airplane construction are to receive attention when the fifth annual Army-Navy conference for the standardization of aeronautical materials and parts is to be held at the Naval Aircraft Factory, Navy Yard, Philadelphia, during the week beginning February 11. Among the subjects on the agenda are: Steels, aluminum and aluminum alloys, dopes and paints, lumber, power plants, propellers, instruments, rivets, nails, pins, gromets and eyelets. Tentative drawings and specifications have been prepared after a preliminary conference between Army and Navy representatives, but the ultimate success of the standardization will depend to a great extent upon the cooperation of the commercial branch of the industry. It is expected that the Philadelphia meeting will have considerable effect upon the aircraft industry and its current development.

Record Flight Presages New Stride in Aviation

As if to signalize the beginning of an even greater year of advancement than the last, the Army monoplane *Question Mark* left the Los Angeles Airport on New Year's Day and up to the time of this writing, Jan. 7, was still aloft, having been refueled a large number of times while in flight. Every existing record of sustained flight, even for lighter-than-air ships has been broken, and the enormous increase in reliability of the modern air-cooled motor established beyond a doubt. The effect upon the public of this alone should account for more rapid strides of the industry this year, than occurred following the spectacular trans-Atlantic crossings a year ago.

The Lockheed Aircraft Co. announces a production schedule of 200 airplanes for 1929. The present capacity is 8 to 10 planes a month. Proceeds from recent financing will be used to construct a new assembly plant near Chicago and to provide additional manufacturing facilities at the plant at Burbank, California.

While air progress has been so noticeable here, we should not forget that Germany has for several years been making rapid strides in commercial aviation. Some figures for the chief operating company are of interest. The Lufthansa Co. transported 1,030 long tons of freight in 1928, compared with 640 long tons in 1927. Planes were patronized by 111,000 persons, as

against 102,000 in 1927, and total kilometers flown were 10,100,000, compared with 9,200,000 the previous year.

The Fairchild Airplane Manufacturing Co. will install a quantity production system patterned after automobile methods. Under this system 1,200 planes will be built in 1929 with very little more labor than went into 175 planes built in 1928, according to a recent newspaper report.

All kinds of foreign motors are being built in this country. Now we learn that the Wright-Tuttle Aircraft Motor Corporation, a new company, has purchased the International Rubber Works factory at Anderson, Ind., and will begin the production of a Belgium type motor, according to V. L. Wright, president.

Widia Metal and Carboloy $500 a Pound

Widia metal and Carboloy, being made in this country under Krupp patents, are said to be selling for $500 per pound, according to a newspaper report in which tests being made at the Bullard Machine Tool Co., Bridgeport, Conn., were described. In the tests, steel was cut at 230 ft. per min. and cast iron at the rate of 600 ft. per min. The tool broke at high speeds due to the failure of the bonding metal that held the tip in the holder. At the present price the metal is worth twice its weight in gold, although the materials that enter into its construction, namely tungsten, carbon and cobalt, are relatively cheap, but require a high degree of refining. The Krupp Works is now turning out about 1 ton, or $1,000,000 worth, a month and is rapidly increasing its capacity. The metal is being made in this country under Krupp license by the Ludlum Steel Co. and the Firth-Sterling Steel Co., and also by the General Electric Co. under the name Carboloy.

American Locomotive Co. Faces Active Year

After going through several years of quiet business, the American Locomotive Co. now has on its books orders for $17,000,000 worth of locomotives. While no figures are available, it is unlikely that the value of shipments in the year just ended amounted to more than $5,000,000. One of the big factors in the present favorable situation, of course was the receipt of an order for 100 locomotives, amounting to something like $9,000,000 from the New York Central, announced last week.

* * * *

It is reported that the Canadian Pacific Railway has under consideration extensive additions to its Ogden shops at Calgary, Alberta, which will call for an outlay of approximately $500,000. The plans, it is stated, are now being considered by the directors in Montreal and an early official announcement is anticipated.

Mergers Are Also Popular in England

The English Steel Corporation, a combination of two of the largest British companies in that industry came into formal existence on December 31 when shareholders of Cammell, Laid & Co. ratified the provisional agreement with the Vickers-Armstrong Co. The new corporation will be capitalized at more than $200,000,000. The terms of this merger are such that the Vickers-Armstrong Co. virtually takes over the the assets of the other concern.

Not many weeks ago several English automobile manufacturers combined, one of the reasons being to strengthen their position against Ford competition as well as that of other foreign manufacturers.

Can American Methods Be Applied in Europe?

Two French experts have recently returned from America and delivered themselves of certain comments on American production methods, says the Paris correspondent of the *American Machinist*.

The first is a well-known economist, Antoine de Tarle, who comments on the American principle of high wages in the *Revue des Deux Mondes;* the second is Lucien Rosengart, a former director of the Peugeot Co. and now the manufacturer of the continentalized Austin Automobile of England, called in France, the Rosengart, who views American production methods in *Foreign Trade*, the publication of the American Chamber of Commerce in Paris.

Monsieur de Tarle states that industrial conditions differ so greatly in America from what they are in Europe that it is by no means certain that higher wages would be a benefit, or could be applied, in either France, Germany or Great Britain. Important and continuous technical progress and scrapping of old methods and machinery could hardly be universally adopted in Europe as in America, largely for material, rather than for technical, reasons. He believes that Mr. Ford's practice of allowing no waste either of material or labor and the recuperation of all kinds of scrap is something which might better be applied in Europe to bring down costs, rather than a largely increased output by radical methods yet to be proven suitable for application in Europe.

He considers that France was long ago more systematized in its production than America, and it was from the fact that America lagged behind that it was possible to "Taylorize the country," as he put it. He believes that the scientific and rational bases in use in France at the beginning of Taylorism were entirely unsuspected in America; hence industry was willing to adopt them, ignoring that Descartes, a Frenchman, in his *Discours sur la Method*, told the world three centuries ago that difficulties should be divided into as many parts as possible and those parts tackled in turn.

He contends that wages can only rise as parallel reductions of other production elements are brought into play, and that many French industries have done already in this direction all that is possible.

Monsieur Rosengart's summing up was more genial: he admitted that the mentality of the American workman was far different from that of the French workman and regretted that the co-operative spirit of effort and discipline was not the equal in France of that of America. "I emphasize," he says, "the necessity of French engineers to study American methods. There the young generation will find an admirable school of energy and practical sense. In the future an idle man should be as rare in France as one in America."

He states that the collective effort is what has made American manufacturers so successful and wishes that collaboration of French banks with industrial enterprises might be closer. He recognizes that there are fewer functionaries who produce nothing for the general good in America and that the productiveness of all classes is such that wages are high and prices low.

A Record of Continuous Employment

Sixty-four persons, 42 of whom are still in active service, were awarded 50-year gold badges by the International Silver Co., Meriden, Conn., at a recent meeting of the Foremen's Association. Among the veterans were the chairman of the board, two vice-presidents, and the secretary and treasurer. It is also interesting to note that 483 employees have been in service 25 years or more, and 833 more than 10 years. The longest period of continuous employment was 61 years.

Leipzig Fair to be Held This March

The Leipzig Trade Fair will be held March 3 to 13, 1929, in Germany. Some 11,000 exhibits assembled from 24 countries will be assembled and fully 200,000 buyers from 44 countries other than Germany. Special preparations have been made to serve visitors this year in the matter of banking facilities and the arrangement for packing and shipping goods. At the last spring fair more than half a billion dollars worth of goods were sold within a week, of which one-half were for export. The spring fair will have three times as many exhibits and ten times as many visitors as any pre-war fair. America will be represented by some seventy exhibits, and 2,200 buyers from all parts of the United States are expected to attend. Detailed information concerning the fair may be obtained from the Leipzig Trade Fair, Inc., 11 West 42nd St., New York.

BUSINESS BAROMETER . . . . *If current forecasts are even partially correct, the year ought to be the most prosperous one in our history*

By THEODORE H. PRICE
Editor, Commerce and Finance, New York

From this page the reader will get a quick picture of current business and industry. The boxed material below is a summary of the letters from regional correspondents of the American Machinist, published in full on the opposite page.

THE business prophets of 1929 are almost unanimously optimistic, and if their forecasts are even partially correct, the year upon which we are just entering ought to be one of the most prosperous in the industry of the United States.

That we are in a period of inflation, however, is coming to be generally admitted. There are a few items in the week's news which demonstrate this so forcibly that they have attracted widespread attention.

One is a report that John D. Rockefeller, Jr., has paid $100,000,000 for three blocks of property in New York City, that were rented at $400 a year in 1828, an apt example of the effect that the increase in the nation's wealth has had upon values.

Another item of the same character is the announcement that the real estate sold in New York City during the year 1928 was assessed for more than $2,500,000,000 and was mortgaged for upwards of $1,500,000,000.

A third statement of similar import is to be found in a speech delivered last week by Carl Snyder of the Federal Reserve Bank of New York. Mr. Snyder said that millionaires in the United States had increased from 7,000 in 1914 to between 30,000 and 40,000 in 1928, and he added that, "possibly half or more of these new millionaires have been created by the violent debasement in the value of the currency which has taken place since the beginning of the War, and a considerable proportion of the increase must be due also to the enormous rise in the value of securities and the colossal manipulation in the stock market, incomparably the greatest gamble the world has even known."

Mr. Snyder concluded by saying that "when fortunes can be made by gambling in pieces of paper, of what attraction are the unique virtues of industry, sobriety and thrift? These are temporarily thrown into the discard, reluctantly and discontentedly to be resumed when the house of cards has crumbled."

In the cities everything appears to be prosperous. The grocery chains, the mail-order houses and the department stores all report increased sales. But rural merchants and the farmers complain that they are not sharing in the prosperity enjoyed by the rest of the country, and that if this prosperity is real, higher prices for agricultural products ought soon to be obtainable.

Therefore, it is reasonable to expect that a strenuous effort will be made to get the present Congress to pass some measure of farm relief before it adjourns.

Much depends upon the attitude of the national legislature toward this important question, and it is a factor that should not be ignored in considering the outlook for business in the comparatively near future, for it is daily becoming more evident that the boom in Wall Street cannot continue unless the much-talked-of prosperity is more evenly distributed.

Meantime money continues scarce and dear, and the hope of a decline in commercial interest rates is still deferred, although the call rate has declined from the high of 12 per cent reached early last week. Brokers' loans as reported by the Federal Reserve Bank of New York increased $239,000,000 for the week, while the monthly compilation by the Stock Exchange showed that borrowings by its members as of December 31 totaled $6,440,000,000, a new high record.

Another $25,000,000 in gold has been earmarked for export. Therefore a concurrent expansion of the credit structure and contraction of its base is occurring. To be sure we have witnessed the same phenomena during the last year and a half, but it is idle to suppose that it can continue indefinitely.

An interesting feature of the situation is the decrease in the deposits of the New York State savings banks, reported for the month of November, 1928. This decrease amounted to $1,689,000 as compared with an increase of $11,353,000 in November, 1927. The savings banks officials say that the decrease reflects the diversion of savings to the stock market, and their concern over a development so unusual is expressed though not admitted in the many advertisements that they are publishing in an effort to reattract deposits. They offer 4½ per cent compounded quarterly on any money now entrusted to them.

These advertisements and other financial statistics recently published seem to indicate that we are in for a long period of comparatively high money, and it remains to be seen whether the result will not be a gradual liquidation of a considerable proportion of the stocks now carried on margin.

But no impairment of confidence was manifest last week, and those who seemed to be in control of the stock market found no difficulty in advancing the particular stocks in which they are interested. For their bullishness they found support in most of the business news published, including particularly the announcement that Ford would run his automobile plants six days a week instead of five as previously. The publicity value of this announcement has been great, and it has had a pronounced effect upon all the industries that are dependent upon the automobile business.

The world elsewhere is about as it was last week, and the outlook seems to be satisfactory, except as it may be impaired by the higher cost of credit.

MACHINE tool builders closed a record year's business, owing largely to activity on the part of automotive manufacturers, and therefore the fact that Detroit started the year off with a sharp rise in employment and increased activity on the part of the manufacturers is significant. Incidentally, the announcement that Ford is to increase his personnel by 30,000 has been responsible to a large extent for the impetus given trade in that locality. Furthermore, machine builders in Cincinnati already report the receipt of large orders and inquiries from the automotive field.

CHICAGO has just closed one of the best months of the year, and with inquiry on the increase January is expected to be a close second. Little effect of the holidays has been noted there, as elsewhere. In New England the effect was less noticeable on trade than it has been for some time, and in Indianapolis, also, there were fewer days lost taking inventory than usual. In fact, many machine builders are increasing their work schedules in an effort to catch up with the large volume of unfilled orders, and in a few cases night shifts are being employed.

TRADE in the South is still rather quiet, but inquiries indicate a pick-up in the near future. Several railroad shops are under construction there and future business is seen from such sources. Several Western roads also have announced large programs of expenditure, but it is too early to state how much will go toward shop equipment.

IN CANADA all branches of the metal-working industry are preparing for an intensive resumption of activity this month.

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The Industrial Review

The week's progress of the machinery and machine tool business

THE following reports, gathered from the various machinery and machine tool centers of the country, indicate the trend of business in these industries and what may be expected from the future:

NEW ENGLAND

The turn of the year finds industrial conditions in the New England section very promising. The holidays brought the usual quietness, the effects of which are still noticeable, but to a lesser extent than at this time for several years past. Manufacturers of machinery and machine tools anticipate an early resumption of the high level of activity that featured the last quarter of 1928.

Some companies have already increased working schedules and plan to add more men in an effort to solve the delivery problem. The Pratt & Whitney Co., Hartford, has added 100 men to its night force, and has an ever growing large list of unfilled orders. The Pratt & Whitney Aircraft Co. is employing 125 men on a night shift, which will be increased to 150 during the present month and later to 200 men. The United States Navy has placed an order with this company for 136 additional Wasp airplane motors and parts totaling $1,080,000 in value.

The radio industry is a prominent factor for the purchase of equipment in this territory. Automotive lists hold up well but the trade looks for a better tone to this market later. Railroad buying is not a reliable factor at this time, and the future is indefinite although improvement is expected. Aeronautical leaders look for a year of greatest expansion and development. Buying from this source is expected to be the feature of a year which at this time displays unusual promise from every angle.

INDIANAPOLIS

Naturally, the machine tool and machinery business here has not recovered from the holiday lull, but the outlook is bright. Some inquiries are being received which enhance the favorable outlook. A few orders are being received also, but they are somewhat scattering and call generally for a wide variety of small tools.

One significant feature is the fact that many Indiana factories which usually shut down for the entire holiday week for inventory, worked both the day before Christmas and the day after and also the same on New Year's, working to capacity between the two. The days lost for inventory this year were fewer by far than they have been for years.

Manufacture of general machinery is active. Some extensive inquiries are being received for brick-making machinery from plants in the western part of the state. Some of them are finding it necessary to curtail their operations while new installations are being made. Judging from inquiries, there will be a good demand shortly for special printing machinery, cutters, small presses, and stereotype equipment being wanted. A fair demand is seen for coal mining machinery and with the coming of severe weather the first of the year, more mines are expected to get into operation.

The trade is expecting fully as much demand for special machinery from the automobile body plants this year as last. They entered the new year in a very advantageous position following the best year of their history. Demand from the automobile factories is somewhat spotted. Most of the factories are all set for the New York show, and following this an increase in their requirements is expected.

The iron industry in this state is rather marking time and doing little tool buying, but conditions seem more favorable than they were this time last year.

CANADA

All branches of the metal-working industry in Canada are preparing for an intensive resumption of business following the holiday lull. According to present indications, the prospects for the first quarter are excellent. Car building plants, especially, have entered the new year in a very favorable position. The Canadian Car and Foundry Co. has orders on hand totalling $22,250,000; while the Eastern Car Co., a subsidiary of the British Empire Steel Corporation, has received to date, orders for 1,600 cars, valued at approximately $7,000,000. These orders will enable the company to operate at capacity for the next six months at least.

The plants of Canada Foundries and Forgings are busy on large orders. The forge plant at Welland, in addition to its usual volume of business in heavy forgings for paper machine manufacturers and hydraulic equipment manufacturers, has received an order for all the forgings and bushings for the new South Shore Bridge, at Montreal, and nearly all the forgings required on the bridges erected on the Welland canal. The plant at Brockville, Ont., showed an increase of approximately 20 per cent in sales for the first eleven months of 1928 as compared with the same period in 1927.

The Canadian General Electric Co. has received a large order from the Mersey River Paper Co. for motors for the new Liverpool mills in Nova Scotia. The Canadian Govenment has just placed an order with the De Haviland Aircraft Co. of Canada, Ltd., for 34 De Haviland Moth light aeroplanes. The order approximates $200,000 in value.

Old material markets are vigorous, and enquiries are numerous. A good volume of buying is looked for in this market during the next two or three weeks.

SOUTHERN DISTRICT

Machinery and machine tool business has been rather quiet in this district the past two weeks, with a brisk inquiry reported for 1929 wants that seem to promise the booking of a number of good orders this month, but only a few small orders as yet being placed.

Some orders for woodworking machinery were placed the last part of the year, mainly by the furniture manufacturing plants in the North and South Carolina, Georgia and East Tennessee territory, as this industry is apparently planning expansion and facing an excellent year. The millwork outlook also seems promising, and orders for woodworking equipment from this field are expected to develop within the next few weeks. Other lumber industries seem less promising.

A few small orders are coming in from railroad companies, and with several important shop building projects planned for the near future distributors also look for a heavier buying from this field during January and February. The textile industry also is placing a few orders and has a fine outlook.

Various southeastern states are preparing for extensive road building and road maintenance programs this year, and will be asking for bids shortly on all types of road-building machinery. The building outlook is also good and contractors' equipment is expected to move well. On the farms the outlook is not as promising as it might be, and distributors are only looking for about a normal, or possibly a less than normal, demand the next few months for tractors and farm machinery, though industrial demand for tractors is expected to be fairly heavy.

A fair number of orders are being placed for used machinery or rebuilt equipment, mainly by garages, service stations and smaller machine shops, and there seems little prospect that these industries will be active in the market for other than this type of machinery during the early part of the year.

CHICAGO

The month of December is reported by machine tool interests to have been one of the best months of the year from the standpoint of sales volume. In a few instances it was said to have exceeded any other month in 1928 in this respect. With the advent of the new year there came inquiries in increasing number, giving promise of a January business greatly in excess of that for the corresponding month in 1928. Two holidays within a week have had some effect on the market, as was to have been expected. It has been slight, however, and general activity again prevails among the machine tool trade. Inventory taking, it is thought, may hold back orders to some extent for a limited period, but, that over, it is confidently predicted that the high level which characterized the final months of last year will be attained.

Some Western railroads are reported to have appropriated exceptionally large sums for new equipment, but their budgets not yet having been completed it is not known just what portion of the proposed expenditure will be for shop equipment, the figures thus far given out applying only to rolling stock, improvements and track extension. The Rock Island is especially mentioned in this last connection.

CINCINNATI

Machine tool manufacturers in the Cincinnati district report that in the past week business was at a good level. Taking the industry as a whole, there was a gain in sales, and there are many signs of further improvement. "We were very much surprised," said one manufacturer, "at the receipt of several good-sized orders from the automobile field, right after the first of the year."

Selling agents report that they had a good volume of business in the past week. The market in local and adjacent territory is becoming livelier, it is stated, and the amount of sales resistance is lessening.

What is regarded as an encouraging feature of the week's market is the fact that orders from the automotive industry, including its allied trades, increased both in number and in size. The sustaining feature of the past week's business continued to be orders from general machinists and miscellaneous users, located in all sections of the country, whose requirements were a well-assorted variety of single tools and replacements.

An increased number of inquiries were received during the week, some of which called for several tools. A much larger amount of business is pending than there was at this time last year, it is stated. Due to the fact that many of the orders

are calling for rush shipments, plants of manufacturers are very active and some are working overtime.

DETROIT

The new year started off auspiciously in the Detroit district with the leaders in the automotive and associated industries making extensive plans for increased production and with machinery and machine tool dealers looking forward to a period as good, or almost as good as 1928.

Already a large number of good sized orders have come in, and there is every indication that more are on the way. Many changes are being planned by industries and it seems likely that some of them will involve large expenditures for machinery and equipment.

Employment has gone up fairly rapidly following the holiday inventory let-up. A total of more than 36,000 men were hired during the first week in the immediate Detroit area. The announcement that the Ford Motor Co. will employ 30,000 more men has given a big impetus to general business here and throughout the whole state. There is a decidedly optimistic atmosphere prevailing in all lines of business and industry.

The increasing export trade in the automobile business, the prosperity of the country in general and the favorable prospects for business attendant upon the election of Herbert Hoover all have a tendency to make the beginning of 1929 particularly prosperous. In many respects the beginning is even better than last year.

NEW YORK

There is every indication that the activity in the machine tool market evident during the past year right up to the end will be continued this month, and January business ought to equal, if not exceed, that of December. While the volume of orders placed immediately after the first of the year was not noticeably large, most dealers and factory representatives stated that they had plenty of business pending which they expected to be closed within the next few weeks. Some of these embryo orders are said to involve a number of machines. Many buyers who have not been heard from in some years are now showing signs of interest in new equipment, and are learning for the first time that delivery is no longer a question of weeks. Despite the fact that many tool builders are working overtime, the delivery situation has become more serious each week.

The Triplex Machine Tool Co. reports the sale of three jig borers, three Campbell nibblers, two cold metal saws, a Mikron hobber, a metal band saw, and a large upright drill press. The company anticipates a good month.

The Pratt & Whitney Co. reports the sale of seven lathes, two surface grinders, six jig borers, six drills, a hand miller and a vertical shaper.

Shepard and Niles Crane Companies Merged

The Shepard Electric Crane & Hoist Co., including its Sprague division, and the Niles Crane Corporation formerly a division of the Niles-Bement-Pond Co., have been combined under the name of Shepard-Niles Crane & Hoist Corporation. The Shepard plant at Montour Falls, N. Y., and the Niles plant at Philadelphia, will be continued in operation. Officers of the Shepard-Niles Crane & Hoist Corporation are: Col. E. A. Deeds, chairman of board; S. G. H. Turner, chairman of executive committee; Frank A. Hatch, president, and Sydney Buckley, first vice-president. In addition to the above officers and the other members of the former Shepard Electric Crane & Hoist Co., the directors will include Leonard S. Horner, president, and Chas. K. Seymour vice-president of the Niles-Bement-Pond Company.

Holiday Greetings

The editors of the *American Machinist* take this opportunity to acknowledge holiday greetings from the following: The Anderson Die Machine Co., Bridgeport, Conn.; Battey H. Kipp, Inc., Chicago; the Norma-Hoffman Bearings Corporation, Stamford, Conn; John Law, Ottawa, Canada; the Cincinnati Planer Co., Cincinnati, Ohio; and the Hoggson & Pettis Manufacturing Co., New Haven.

S. A. E. Annual Meeting Plans Announced

Sessions devoted to passenger car performance, car bodies, engine research, production, chassis and engine design are among the topics to be discussed at the annual meeting of the Society of Automotive Engineers to be held at the Book-Cadillac Hotel, Detroit, Mich., January 15 to 18, 1929. At the production session M. F. Macaulay, engineer of the Oakland Motor Car Co. and M. F. Phillips of the General Motors Corporation Research Laboratories will jointly present a paper on the recent developments in chromium plating, while B. H. Work of the Carborundum Co. will speak on recent developments in grinding. P. M. Jasper, of the A. O. Smith Corporation, will deliver a paper on the selection of material for use in production in the automotive industry.

Business Items

Articles of incorporation have been filed by the Mayer Brothers Co., the new owner of the old Crawford & McCrimmon Foundry and Machine Works at Brazil, Ind. Preparations have been started to enlarge the operations of the company. It is planned to begin the manufacture on a large scale of mining machinery, pumps, power hammers, boilers and engines. The new company has a capital stock of $50,000, of which half is common and half preferred. The incorporators are Lorenz L. Mayer, Louis Mayer and Bertram L. Mayer. For years the Crawford & McCrimmon organization did a big business, but financial difficulties began during the period of depression following the War.

The Sacks-Barlow Foundries Inc., Newark, N. J., has been formed to take over and consolidate Louis Sacks, Inc. and the Barlow Foundry Inc., both of Newark and both specialists in gray iron castings. The new organization has bought out the Morrison-Flockhart Foundry Corporation, another gray-iron foundry of Newark and will consolidate it with the other interests. Included in the merger also is the Newark Malleable Iron Co., previously operated as a subsidiary of Louis Sacks, Inc. David L. Sacks is president of the company, Samuel F. Dixon, vice-president, and Arthur E. Barlow, treasurer.

Articles of incorporation have been issued to the American Road Machinery Co., 215 N. Curtis St., Chicago. Capital, 60,000 shares non-par value. The company will manufacture and deal in tractors, engines, machinery, automobiles and radio sets. Incorporators E. J. Robinson, W. R. Brailsford and R. E. Rickson.

The Plumbing & Heating Corporation, of Portland, Ore., has been formed with a capital stock of $250,000 through the merger of the Alaska Plumbing & Heating Co., Fox & Co., Hashcrof & Lord, the Standard Plumbing & Heating Co., and W. T. Finnigan & Co. George C. Root is president and G. C. Motley is secretary-treasurer of the corporation.

The Reed-Prentice Corporation, Worcester, Mass., has appointed the following agents: Crane-Schiefer-Owens, Inc., Buffalo, Rochester and Syracuse, N. Y.; the English Bros. Machinery Co., Kansas City, Mo.; the McDonald Machinery Co., St. Louis, Mo.; Neff Kohbusch & Bissell, Inc., Chicago, Ill., and Milwaukee, Wis.

The Braun Gear Corporation, Brooklyn, N. Y., recently bought out the entire gear division of Micarta Fabricators, Inc., also of Brooklyn, which formerly operated under the name of the Accurate Gear Corporation, and has moved the entire gear department into its own factory, thereby increasing manufacturing facilities by 50 per cent.

William Schall & Co. announce that they have contracted to sell to Spicer Manufacturing Corporation all of the stock of Brown-Lipe Gear Co., Syracuse, N. Y., recently purchased. Operations of the Brown-Lipe Gear Co. will be continued along the same lines as in the past.

The H. D. Smith Co., Plantsville, Conn., which has been in bankruptcy, resumed operations Jan. 1 under a new organization. The company will continue to manufacture the regular line of small tools and a new line of special forgings. It is expected a full force will be employed shortly.

The Conway Clutch Co., Cincinnati, has appointed the Watson-Flagg Engineering Co., Paterson, N. J., distributor of Conway disk clutches in New Jersey, and the Brewster-Nicholas Co., Cleveland, distributor in Detroit, Cleveland, northern Ohio and Michigan.

The Scott Steel Co., of Chicago, announces that the company has changed its name to the Scott-Weiss Steel Co. William G. Weiss has been elected vice-president and treasurer.

In order to cope with the steady increase in business, the Toronto Iron Works, specializing in all kinds of steel plate, has purchased a 9-acre site in Toronto, Ont., where it proposes to construct a new plant immediately at an estimated cost of $500 000 The land purchased by the company involved an expenditure of $175,000.

The Ames Shovel & Tool Co., of Anderson, Ind., has centralized its manufacturing there, closing its Elwood and St. Louis plants. New buildings have been erected and additional equipment purchased, greatly enlarging the capacity.

The Aldeen Manufacturing Co., 426 S. Main St., Rockford, Ill., has been incorporated. Business of tool and metal stamping. Capital $100,000 common. Incorporators: Thorsten Erickson, Reuben Aldeen and E. B. Erickson.

Personals

H. L. R. EMMET has been appointed manager of the Erie (Pa.) works of the General Electric Co., and J. E. BROBST has been made manager of the Bloomfield (N. J.) plant of the same company, the one succeeding Matthew Griswold, the other C. D. Knight, both of whom retired from active service on Jan. 1 because of ill health. Since 1922 Mr. Emmet has been production manager of the Schenectady works. Mr. Brobst came to the company in 1903 and since 1920 has been engineer of the industrial control engineering department at Schenectady. He will continue to act as engineer of this department, having general supervision over the engineering departments at both Schenectady and Bloomfield.

JAMES B. TRUMBULL, Wollaston, Mass., was appointed industrial development agent in the territory served by the Eastern lines of the New York, New Haven & Hartford R.R., and will have offices at Boston, Mass., and Providence, R. I. The Industrial Development Committee of which he will be agent, was formed in 1919 to encourage and find suitable locations for new industries wishing to locate in the territory, and has had marked success under the direction of A. P. Russell, vice-president.

J. H. BERNSEE, formerly connected with the National Acme Co., Cleveland, has joined the sales force of the Gisholt Machine Co., of Madison, Wis., and will cover the Illinois and Iowa territory from the Chicago office. Cliff Baxter, machine shop superintendent of the Chicago territory, is now permanently connected with that office as special service expert.

A. M. OLIVER, for six years in the advertising department of the Goodyear Tire & Rubber Co., Akron, Ohio, has become advertising manager of the Pangborn Corporation, Hagerstown, Md., manufacturer of sand blast and dust-collecting machinery.

R. W. OTT has joined the Oesterlein Machine Co., Cincinnati, Ohio, as sales manager. For the last six years he has been engaged in similar work with the Kearney & Trecker Corporation, of Milwaukee.

HORACE ROSS, for many years assistant purchasing agent with Henry Disston & Sons, Inc., Philadelphia, Pa. has just been made assistant manager of steel sales of the company.

Obituaries

EUGENE KIBELE, 57, president of the Kibele Manufacturing Co., San Antonio, Texas, died suddenly of heart trouble Dec. 28, 1928. Mr. Kibele had been prominently connected with the manufacturing industry for many years. He was connected with the Bullock Electrical Co. and the Allis-Chalmers Manufacturing Co. of Milwaukee during the first decade of the present century. He was general superintendent of the Henry R. Worthington Pump Works at Harrison, N. J., and later was one of the pioneer workers in the rotary drilling field as general manager of the J. F. Lucey Co. at Chattanooga, Tenn. He also served as vice-president and general manager of Clark Brothers, of Olean, N. Y., from 1916 to 1920. He had won decided success with his piston and his swab, his own inventions, in the Southwestern oil fields during the past few years. Mr. Kibele's business in San Antonio is at present being continued under the supervision of his daughters, Mrs. Madeline K. Barr of Los Angeles and Mrs. Eugenia Schroeder of Denton, Texas.

HARRY A. JANSEN, aged 68 years, for the last 20 years secretary of the Tri-City Manufacturers Association, one of the most widely known industrial executives in the Middle West, died Dec. 27 in Moline, Ill., following an operation. He was born in New York City, May 1, 1860, and spent his early years in the East and South, later going to Canada and coming to the Moline district 20 years ago as secretary of the manufacturers' association, which he developed into one of the strongest forces in that section of the country. He took an active part in the National Association of Manufacturers, the United States Chamber of Commerce, the American Open-Shop Conference, the Illinois Industrial Council, which he organized and of which he was first president, the Employers' Association of Illinois, the National Metal Trades Association and the National Founders' Association.

WILLIAM G. ALLEN, who founded the Allen Screw Manufacturing Co., Hartford, Conn., and was formerly president of the American Specialty Co., died Dec. 28 at Hartford, following a prolonged illness. Mr. Allen was 67 years old and was well known as the inventor of the Allen screw and several mechanical devices. He was at one time connected with the Wright Manufacturing Co. and perfected the Wright die machine. At the death of Henry Wright he reorganized the Wright company and was sales manager of the company at the time of his death. He also acted as purchasing agent for a number of foreign machine companies.

JOHN LEWIS PERKINS, 67, head of the paper machinery manufacturing company of B. F. Perkins & Son., Holyoke, Mass., and a prominent figure in the paper manufacturing industry, died Dec. 27 at his home in Holyoke, following an illness of three days. Mr. Perkins was prominent in the development of the telephone switchboard and paper-making machinery.

C. G. ROWLETTE, vice-president of the Timken Detroit Axle Co., Detroit, Mich., died suddenly on Dec. 24.

Forthcoming Meetings

WESTERN METAL CONGRESS AND WESTERN STATES METAL & MACHINERY EXPOSITION. Held in Los Angeles, Jan. 14-18, under the auspices of the American Society for Steel Treating. W. H. Eisenman, secretary, 7016 Euclid Ave., Cleveland.

SOCIETY OF AUTOMOTIVE ENGINEERS. Annual meeting, Jan. 15-18, Book-Cadillac Hotel, Detroit. C. E. Haywood, in charge of meetings, 29 W. 39th St., New York City.

AMERICAN MANAGEMENT ASSOCIATION. Production Executives' conference, Feb. 27-28 and Mar. 1, at the William Penn Hotel, Pittsburgh, Pa. Oscar Grothe, vice-president in charge of the production executives' division, c/o White Sewing Machine Co., Cleveland, Ohio.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Regional meeting in Knoxville, Tenn., March 21-22, 1929. W. R. Woolrich, professor of mechanical engineering, University of Tennessee, Knoxville, in charge of program.

AMERICAN MANAGEMENT ASSOCIATION. Marketing Executives' Conference, April 3-4, at the Hotel Gibson, Cincinnati, Ohio. George R. Cain, vice-president in charge of the marketing Executives' division, American Management Association, 20 Vesey St., New York City.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Semi-annual meeting, July 1-4, 1929, in Salt Lake City, Utah. Calvin W. Rice, secretary, 29 W. 39th St., New York City.

The Weekly Price Guide

Rise and Fall of the Market

COPPER sheets, wire and bars are up ¾c. and copper tubing, brass sheets, tubing, rods and wire, ½c. per lb. at New York warehouses, this week. Similar advances occurred in Chicago, Cleveland and other important centers all following the recent rise in raw metal. Scrap brass and copper reflect the upward movement of non-ferrous metals, in the advances reported this week at New York and Chicago. Straits tin in pigs, sold in small lots at New York warehouses, is down ¼c., to 52¾c. per lb. Solder also ran contrary to the trend in other metals by declining 1c. per lb. at Cleveland. Steel prices remain unchanged, with mill operations at 84 per cent of capacity or 14 per cent above the rate obtaining at this time last year.

(All prices as of Jan. 4, 1929)

IRON AND STEEL

PIG IRON—Per gross ton, f.o.b:

CINCINNATI	
No. 2 Southern (silicon 1.75@2.25)	$19.94
Northern Basic	20.89
Southern Ohio No. 2	21.19
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 1.75@2.25)	25.50
BIRMINGHAM	
No. 2 Foundry (silicon 1.75@2.25)	16.50@17.00
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	21.76
Virginia No. 2	27.17
Basic	20.76
CHICAGO	
No. 2 Foundry local (silicon 1.75@2.25)	20.00
No. 2 Foundry, Southern (silicon 1.75@2.25)	22.26
PITTSBURGH, including freight charge ($1.75) from Valley:	
No. 2 Foundry	19.26
Basic	19.26
Bessemer	21.26

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb:

Detroit	4.50
Cleveland	5.00
Cincinnati	4.30
New York	5.25
Chicago	4.50@4.75

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the mill base in large lots:

Blue Annealed	Pittsburgh Mill Base	Chicago	Cleveland	New York
No. 10	2.00@2.10	3.35	3.25	3.90*
No. 12	2.06@2.15	3.40	3.30	3.95*
No. 14	2.15@2.25	3.45	3.35	4.00*
No. 16	2.25@2.35	3.55	3.45	4.10*
Black				
Nos. 18 to 20	2.55@2.65	3.60	3.40	4.00
No. 22	2.70@2.80	3.75	3.55	4.15
No. 24	2.75@2.85	3.80	3.60	4.20
No. 26	2.85@2.95	3.90	3.70	4.30
No. 28	3.00@3.10	4.50	3.85	4.45
Galvanized				
No. 10	2.70@2.80	3.95	3.75	4.25
Nos. 12 to 14	2.80@2.90	4.05	3.85	4.35
No. 16	2.90@3.00	4.15	3.95	4.45
No. 18	3.05@3.15	4.30	4.10	4.60
No. 20	3.20@3.30	4.45	4.30	4.75
No. 22	3.25@3.35	4.50	4.35	4.80
No. 24	3.50@3.60	4.65	4.45	4.95
No. 16	3.65@3.75	4.90	4.70	5.20
No. 28	3.90@4.00	5.15	4.95	5.45

*250 to 3,999 lb.

WELDED STEEL PIPE—Warehouse discounts are as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 3 in., butt welded	50%	36%	55½%	43½%	54%	41%
2½ to 6 in., lap welded	45%	32%	53½%	40½%	51%	38%

WROUGHT-STEEL PIPE LIST

Size, Inches	List Price per Foot	Diameter in Inches—External	Diameter in Inches—Internal	Thickness Inches
1	$0.17	1.315	1.049	.133
1¼	.23	1.66	1.38	.14
1½	.27½	1.9	1.61	.145
2	.37	2.375	2.067	.154
2½	.58½	2.875	2.469	.203
3	.76½	3.5	3.068	.216
3½	.92	4.0	3.548	.226
4	1.09	4.5	4.026	.237
4½	1.27	5.0	4.506	.247
5	1.48	5.563	5.047	.258
6	1.92	6.625	6.065	.28

SEAMLESS STEEL TUBING—Following net prices are for seamless mechanical tubing, cold drawn, round, .10 to .30 carbon, at New York warehouse in lots of less than 100 ft. or 100 lb:

Thickness—Decimal Fractions	B.w.g. and	Outside Diameter in Inches—⅛	¼	⅜	½	⅝	¾	⅞
		Price per Foot						
.035"	20	$0.15	$0.16	$0.17	$0.18	$0.19	$0.21	$0.23
.049"	18	.17	.18	.19	.20	.21	.23	.25
.065"	16	.19	.20	.21	.22	.23	.25	.27
.083"	14	.20	.22	.23	.24	.25	.27	.29
.095"	13	.21	.23	.25	.26	.27	.29	.31
.109"	12	.22	.24	.26	.27	.28	.30	.32
.120" or .125"	11	.23	.25	.27	.28	.29	.31	.33
.134"	10	.24	.26	.28	.29	.30	.32	.34

MISCELLANEOUS—Warehouse base prices in cents per lb:

	New York	Cleveland	Chicago
Spring steel, light*	4.50	4.65	4.65
Spring steel, heavier	4.00	4.00	4.00
Coppered Bessemer rods	6.05	6.00	6.20
Hoop steel	4.50†	4.00	4.15
Cold rolled strip steel	6.25	6.00	6.10
Floor plates	5.10†	5.30	5.00
Cold drawn, round or hexagon‡	3.40	3.65	3.60
Cold drawn, flat or square‡	3.90	4.15	4.10
Structural shapes	3.30†	3.00	3.10
Soft steel bars	3.25†	3.00	3.00
Soft steel bar shapes	3.25†	3.00	3.00
Soft steel bands	4.00†	3.65	3.65
Tank plates	3.30†	3.00	3.10
Bar iron (2.75 at mill)	3.24	3.00	3.00
Drill rod (from list)	60%	55%	50%

*Flat, 1/16@½-in. thick. †250 to 3,999 lb., ordered and released for shipment at one time. ‡Cold finished steel, shafting and screw stock.

Electric welding wire, New York, 3/32, 8.35c.; ⅛, 7.85c.; 5/32 to ½, 7.35c. per lb.

METALS

Warehouse Prices in Cents Per Pound for Small Lots:

Copper, electrolytic, New York			16.75
Tin, Straits, pigs, New York			52.75
Lead, pigs, E. St. Louis	6.50	New York	8.00
Zinc, slabs, E. St. Louis	6.35	New York	8.00

	New York	Cleveland	Chicago
Antimony, slabs	12@13	12.75	14.25
Copper sheets, base	25.62½	25.62½	25.37½
Copper wire, base	22.00	21.50	18.12½*
Copper bars, base	24.12½	23.87½	24.37½
Copper tubing, base	26.87½	26.62½	26.62½
Brass sheets, high, base	21.00	20.75	20.75
Brass tubing, high, base	25.87½	25.62½	25.62½
Brass rods, high, base	18.75	18.50	18.50
Brass wire, high, base	21.50	21.25	21.25

*At mill.

Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Aluminum ingots, 99%.....	25.00*	24.30	24.30
Zinc sheets (casks).....	10.00@10.50	11.00	10.11
Solder (½ and ½).....	34.75	34.00	31@34
Babbitt metal, delivered in case lots, New York, cents per lb:			
Genuine, highest grade.....			67.00
Commercial genuine, intermediate grade.....			53.00
Anti-friction metal, general service.....			31.50
No. 4 babbitt (f.o.b.).....			12.25

*Delivered.

NICKEL AND MONEL METAL—Price in cents per lb., base, f.o.b. Huntington, W. Va:

	Nickel	Monel Metal
Sheets, full finished.....	52.00	42.00
Sheets, cold rolled.....	60.00	50.00
Strip, cold rolled.....	55.00	45.00
Rods, hot rolled.....	45.00	35.00
Rods, cold rolled.....	53.00	40.00†
Tubing.....	75.00*	90.00
Angles, hot rolled.....	50.00	40.00
Plates.....	52.00	42.00

*Seamless. †Cold drawn.

OLD METALS—Dealers' purchasing prices in cents per pound, f.o.b. cars, depending on quantity:

	New York	Cleveland	Chicago
Crucible copper.....	14.37½@14.50	13.75	13.25 @13.75
Copper, heavy, and wire.	13.25 @14.25	13.00	12.67½@13.00
Copper, light, and bottoms	12.00 @12.50	11.50	11.50 @12.00
Heavy lead.....	5.12½@ 5.37½	6.25	4.75 @ 5.25
Tea lead.....	3.50 @ 4.00	4.25	3.75 @ 4.25
Brass, heavy, yellow.....	8.00 @ 8.25	8.50	8.25 @ 8.75
Brass, heavy, red.....	10.75 @11.25	....	10.75 @11.25
Brass, light.....	6.50 @ 7.00	6.75	7.25 @ 7.75
No. 1 yellow rod turnings.	9.00 @ 9.50	9.50	9.25 @ 9.75
Zinc.....	3.25 @ 3.75	3.25	3.00 @ 3.50

TIN PLATES—Charcoal—Bright—Per box:

	New York	Cleveland	Chicago
"AAA" Grade:			
IC, 14x20.....	$12.10	$11.95	$11.50
"A" Grade:			
IC, 14x20.....	9.70	9.90	9.50
Coke Plates—Primes—Per box:			
100-lb., 14x20.....	6.45	6.10	7.00
Terne Plates—8-lb. Coating—Small lots—Per box:			
IC, 14x20.....	7.75@8.00	7.00	7.50

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.*	$0.10@0.13½	$0.16	$0.15
Cotton waste, colored, per lb.*	.09@ .13	.12	.12
Wiping cloths, washed white, per lb.†.....	.16@ .16½	38.00 per M	.16
Sal soda, per lb.....	.02	.02	.02
Roll sulphur, per lb.....	.027	.03½	.04
Linseed oil, raw, in 1 to 4 bbl. lots, per lb.....	.108	.11	.11
Cutting oil, about 25% lard, in 5 gal. cans, per gal.....	.65	.60	.65
Machine oil, medium-bodied (55 gal. steel bbl.) per gal..	.30	.36	.35
Belting — Present discounts from list in fair quantities (½ doz. rolls) for leather or rubber:			
Leather—List price, 24c. per lin. ft., per inch of width, for single ply:			
Medium grade.....	30–10%	30–10%	35%
Med. grade, heavy wgt...	30– 5%	30– 5%	30%
Rubber transmission, 6-in., 6 ply, $1.83 per lin.ft:			
First grade.....	50%	50–10%	50%
Second grade.....	60%	60– 5%	50–10%

*All waste in bale lots. †100-lb. bales or less.

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars.....	per lb..	$0.0325	$0.0325	$0.0324
Cold drawn shafting...	per lb..	.034	.034	.033
Brass rods.....	per lb..	.1875	.1825	.165
Solder (½ and ½).....	per lb..	.3475	.3575	.3675
Cotton waste, white...	per lb..	.10@.13½	.10@.13½	.10@.13½
Disks, aluminum oxide mineral, cloth, No. 1, 6-in. dia.....	per 100.	3.59	3.59	3.10
Lard cutting oil.....	per gal.	.65	.65	.65
Machine oil.....	per gal.	.30	.30	.27
Belting, leather, medium.....	off list..	30–10%	30–10%	35%
Machine bolts, up to 1x30 in., full kegs...	off list..	50%*	50%*	50%*

*List prices as of April 1, 1927.

MISCELLANEOUS—Continued

	New York	Cleveland	Chicago
Abrasive materials — Standard grade, in sheets 9x11 in., No. 1, per ream of 480 sheets:			
Flint paper.....	$4.05	$4.29	$4.29
Emery cloth.....	20.22	20.97	20.97
Disks, aluminum oxide mineral, 6 in. dia., No. 1, per 100:			
Paper.....	2.04	2.04	2.04
Cloth.....	3.59	3.59	3.59
Fire clay, per 100 lb. bag.....	1.00	.75	.75
Coke, prompt furnace, per net ton...	Connellsville,	2.75@2.85	
Coke, prompt foundry, per net ton...	Connellsville,	3.75@4.50	
White lead, dry or in oil...	100 lb. kegs....	New York,	13.25
Red lead, dry.....	100 lb. kegs....	New York,	13.25
Red lead, in oil.....	100 lb. kegs....	New York	14.75

SHOP SUPPLIES

Discounts from new list dated Apr. 1, 1927, applying on immediate deliveries from warehouse stocks in New York and vicinity:

	Full Kegs or Cases
Machine bolts, square heads and nuts:	
Up to ¾ x 6-in.....	55%
Larger, up to 1 x 30-in.....	50%
1¼ and 1½ in. dia.....	35%
Carriage bolts:	
Up to ½ x 6-in.....	55%
Larger sizes.....	50%
Coach and lag screws:	
Up to ½ x 6-in.....	55%
Larger sizes.....	50%
Tap bolts, hexagonal heads.....	40%
Nuts:	
Hot pressed, square or hexagonal, blank or tapped, up to 1-in., incl.....	55%
Cold punched, square or hexagonal, blank or tapped, up to 1-in. incl.....	55%
Semi-finished, hexagonal, tapped, in packages, all sizes.....	40%
Case hardened, hexagonal, tapped, in packages, all sizes.....	30%
Washers: Deduct from list, per 100 lb.....	$3.50*
Rivets, button and cone head:	
Small, including $\frac{1}{16}$-in. dia.....	50–10%
Large (base) per 100 lb. net.....	$5.00†

Note—For less than full package quantities on bolts, screws, hot-pressed and cold-punched nuts, add extra of 10 per cent to list.
*Broken keg lots, $1.50 off list. †Broken keg lots, $6.50 net.

Machine Requirements and Industrial Construction

Equipment Wanted

D. C., Washington—A. L. Flint, General Purchasing Officer of Panama Canal—will receive bids until Jan. 28 for 20 and 40 ton electric traveling cranes.

Ind., Muncie—Coulter Boiler Works, 2407 South Walnut St.. S. P. Coulter, Pres.—acquired the plant of Muncie Boiler & Sheet Iron Co., and will consolidate with South Walnut Street plant. Machinery will be purchased.

Mass., South Boston (Boston P. O.)—M. F. Cahill Co., 710 Second St.—Bliss 19 or 20 power press 2 or 2½ in. stroke.

Mich., Detroit—Cadillac Motor Car Co., 2860 Clark Ave. — miscellaneous foundry equipment for proposed 1 story, 81 x 101 ft. foundry on West Clark Ave. Estimated cost $40,000.

Mich., Detroit — Enterprise Tool Corp., 1590 East Philadelphia Ave. — drill and grinder.

Mich., Detroit — Fruehoff Trailer Co., 10940 Harper Ave. — miscellaneous equipment for assembly of heavy truck trailers for proposed 1 story, 155 x 160 ft. factory on Mack Ave.

Mich., Detroit—Gorham Tool Co., 2206 12th St.—equipment for the manufacture of tools for proposed 1 story, 120 x 125 ft. addition to factory on Woodrow Wilson Ave. Estimated cost $50,000.

Mich., Detroit—Kelsey Wheel Co. Inc., 6100 McGraw Ave.—machinery and equipment for the manufacture of steel rims for proposed 2 story factory. Estimated cost $50,000.

Mich., Detroit — Peter Smith Heater & Mfg. Co., 10501 Haggerty St.—equipment including medium press for sheet metal shop.

Mich., Detroit — U. S. Truck Co., 2537 Ferry Park Ave.—machine shop equipment for proposed 1 story, 75 x 150 and 60 x 220 ft. garage and warehouse. Estimated cost $60,000.

Mich., Muskegon Heights—Pyle Pattern & Mfg. Corp.—equipment for the manufacture of metal patterns also light factory work for automobile parts for proposed 2 story, 40 x 125 ft. factory. Estimated cost $40,000.

Mo., St. Louis—Bd. of Public Service—will readvertise for bids for 10 ton electric box girder crane and hoist for Fire Dept. repair shops in municipal service building. $11,000. Former bids rejected.

O., East Cleveland (br. Cleveland)—Bd. of Education, C. Tilden, Dir., Euclid and Shaw Aves.—machinery and equipment for shop and manual training department for proposed 3 story junior high school. Estimated cost $750,000.

Opportunities for Future Business

Ala., Birmingham—Universal Metal Mfg. Co., H. McDermott, Pres., manufacturers of sheet steel products, plans addition to plant.

Conn., Bristol—New Departure Mfg. Co., will soon award contract for a 1 story, 125 x 130 ft. addition to machine shop on Franklin St. Lockwood, Greene & Co., 24 Federal St., Boston, Mass., Engrs. Noted Nov. 15.

Ill., Belleville—Baker Stove Co., 905 Freeburg Ave., will soon award contract for a 2 story, 128 x 144 ft. factory at Cleveland and Freeburg Aves. Estimated cost $40,000. Gill & Jackson, 520 Buder Bldg., St. Louis, Mo., Archts. Noted Dec. 20.

Ill., Chicago — Storkline Furniture Co., 4400 West 26th St., awarded contract for a 2 story, 80 x 350 ft. factory at 26th and Kostner Sts.

Ill., Chicago—General Engineering Works, 340 West Huron St., manufacturers of screw machine products, awarded contract for a 1 story, 145 x 148 ft. machine shop at 4701 Division St. Noted Nov. 22.

Ill., Chicago—Pines Winterfront Co., J. F. Raleigh, Pres., 404 North Sacramento Ave., is having preliminary sketches made for a 2 story factory for the manufacture of winterfronts for automobiles. Estimated cost $1,000,000. Mundie & Jensen, 30 South La Salle St., Archts. Noted Dec. 13.

Ill., Chicago—Wade Iron Sanitary Mfg. Co., 551 Fulton St., manufacturers of plumbing materials, awarded contract for the construction of a 2 story plant at 1731 South Canal St. Estimated cost $30,000.

Ind., Greencastle — Chevrolet Automobile Co., awarded contract for a 1 story, 60 x 100 ft. machine shop and garage. Estimated cost $43,000.

Kan., Wichita — Travel Air Mfg. Co., awarded contract for a 1 story 75 x 275 and 14 x 40 ft. airplane factory. Estimated cost $40,000.

Me., Lewiston—Wade & Dunton Motors Inc., 28 Park St., will build a 4 story, 110 x 115 ft. factory at Park, Oak and Middle Sts. Estimated cost $100,000. Pulsifer & Eye Inc., 163 Main St., Archts.

Md., Baltimore — E. Katzinger Co., 1949 Cecero Ave., Chicago, Ill., will soon award contract for a 2 story, 143 x 180 ft. factory for the manufacture of bakers' utensils (pans, etc.) tools and machinery here. Lockwood, Greene Co., 24 Federal St., Boston, Mass., Engrs. Noted Nov. 29.

Mass., Dorchester (Boston P. O.)—Mason Regulator Co., Medway St., awarded contract for a 2 story, 80 x 125 ft. addition to plant. Estimated cost $40,000.

Mass., Malden—Boston Steel & Mfg. Co., 112 Bryant St., awarded contract for a 1 story addition to factory.

Mass., Quincy (Boston P. O.)—C. Schutte Body Co., 1620 Park Ave. Bridgeport, Conn., plans the construction of a factory here. Architect not selected.

Mich., Detroit — Motor Products Corp., 11801 Mack Ave., awarded contract for a 1 and 2 story, 60 x 200, 100 x 480 and 60 x 100 ft. automobile parts factory on Mack Ave.

Mich., Detroit—Packard, Motor Car Co., East Grand Blvd., is having preliminary plans prepared for a 4 story, 115 x 425 ft. addition to automobile plant. Estimated cost $450,000. A. Kahn, 1000 Marquette Bldg., Archt.

Mo., St. Louis — H. Chouteau, International Life Bldg., is having sketches made for a 1 story garage at Blair, 14th, Howard and Chambers Sts. Estimated cost $300,000. Aegerter & Bailey, Railway Exchange Bldg., Archts.

N. J., Jersey City—Liberty Auto Radiator Co., 3218 Hudson Blvd., awarded contract for a 2 story, 50 x 100 ft. auto radiator factory and repair shop. Estimated cost $40,000. Noted Nov. 22.

N. J., Kearny—H. H. Oliver, 319 Kearny Ave., will soon award contract for a 3 story, 50 x 200 ft. garage and sales and service building at Kearny St. and Maple Ave. Estimated cost $150,000. Koenigsberger, 48 Walnut St., Newark, Archt.

N. J., Kearny—Western Electric Co. Inc., 195 Broadway, New York, awarded contract for a 6 story, 120 x 420 ft. factory here. Estimated cost $1,000,000. Noted Dec. 20.

N. J., North Bergen—Perryman Electric Co., 30th St. and 4th Pl., manufacturers of radio tubes and electrical appliances, awarded contract for a 3 story, 80 x 200 ft. factory on Hudson Blvd. Estimated cost $100,000.

N. Y., New York—J. McGinnis, c/o J. P. Boyland, 305 Kingsbridge Rd., Archt., will build a 2 story, 88 x 101 ft. garage at Westchester and Waters Aves. Estimated cost $40,000. Noted Jan. 3.

N. Y., New York—R. S. C. Realty Corp., C. J. Joser, Pres., 471 Park Ave., will build a 2 story, 125 x 131 ft. garage at Westchester and Pugsley Aves. Estimated cost $40,000. Cohn & Siegel, 45 West 57th St., Archts. Noted Jan. 3.

N. C., Wilmington — Woodard & Son, American National Bank Bldg., Richmond, Va., plans the construction of several large saw mills along Cape Fear River near here.

O., Canton—Artic Ice Machine Co., 920 Market Ave. S., plans the construction of a 1 story factory for the manufacture of dairy machinery, on Market Ave. S. Estimated cost $100,000.

O., Cleveland—Lake Erie Metal Products Co., Dunham Rd., awarded contract for a 1 and 2 story, 75 x 100 ft. factory on Dunham Rd. Estimated cost $5,000.

O., Newton Falls—Newton Steel Co., First National Bank Bldg., Youngstown, plans extensions and improvements to plant here. Estimated cost approximately $10,000,000 to $15,000,000.

Okla., Oklahoma City—J. B. Klein Iron & Foundry Co., 1006 West Second St., is having plans prepared for the construction of a machine shop and foundry. Estimated cost $75,000. C. J. Thieband, Archt.

Pa., Ambridge—Spang Chalfant Co., will build a 1 story, 240 x 270 ft. extension to tube mill. Estimated cost $500,000. Private plans.

Pa., Ford City—Pittsburgh Plate Glass Co., Frick Bldg., Pittsburgh, will build a 1 story, 70 x 100 ft. addition to polishing and silvering plant here. Estimated cost $40,000.

Pa., New Brighton—Cleveland Laundry Machine Mfg. Co., is having preliminary plans prepared for a 1 story, 30 x 90 ft. plant. Estimated cost $40,000. Private plans.

Pa., New Brighton—Damascus Crucible Steel Castings Co., plans a 1 story, 40 x 127 ft. addition to factory. Estimated cost $40,000. J. E. Wartsolf, New Brighton, Archt.

Pa., New Castle—Johnson Bronze Co., is having plans prepared for a 1 story addition to foundry. Estimated cost $40,000. Private plans.

Pa., Waynesboro—Landis Machine Co., plans the construction of a 1 story addition to factory. Estimated cost $40,000. J. Klinkhart, Hagerstown, Md., Archt.

Ont., Exeter—Columbia Handle Co., R. G. Seldon, Pres., Adelaide St., is having plans prepared for a 1 story, 43 x 150 ft. factory. Estimated cost $40,000.

Ont., Hamilton—National Steel Car Co., plans the construction of a group of factory buildings for the manufacture of automobile parts at Windermere Park. Estimated cost $400,000.

Ont., New Toronto—Anaconda American Brass Co., 8th St., plans the construction of a 2 or 3 story addition to brass plant. Estimated cost $500,000. Private plans.

Ont., Port Hope—Matthews Conveyor Co., plans the construction of a 1 and 2 story addition to plant. Estimated cost $50,000. Architect and engineer not selected.

Ont., Toronto—Rogers Batteryless Radio Co., 90 Chestnut St., is having plans prepared for a 2 story, 125 x 250 ft. plant on Fleet St. Estimated cost $200,000. Horwood & White, 229 Yonge St., Archts.

Ont., Toronto — Toronto Iron Works, Cherry St., plans the construction of a 1 and 2 story steel fabricating plant on Eastern Ave. Estimated cost $500,000. D. Brouse, 514 King St. E., Archt.

Ont., St. Catharines—W. S. Tyler Co. Ltd., 3615 Superior Ave. N.E., Cleveland, O., plans the construction of a factory for the manufacture of woven wire screens on Ontario St. here. Estimated cost $150,000. Architect and engineer not selected.